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Neuroreceptor therapy; the method of Proprioceptive-Deep Tendon Reflex (P-DTR) in functional neurology: from theory to practice

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Abstract: The authors discuss modern approaches from the outlook of evidence-based medicine to the non-drug methods of treatment included in the modern schemes of rehabilitation after various diseases with the focus on one of the rehabilitation methods based on the use of Proprioceptive-Deep Tendon Reflex, a method that has been developed by Dr. José Palomar.

Indexing Terms: musculoskeletal pain; manual therapy; the P-DTR method; proprioception; AK

Introduction

Medical rehabilitation is one of the most effective areas in modern clinical practice when it comes to treatment of chronic pain of various origins. Manual therapy methods used for treatment of joints, ligaments, and muscles have been actively developing. In 2017, the *American College of Physicians* published updated clinical practice guidelines (2017) for non-invasive treatments for acute, subacute, and chronic low back pain.

> *'... Polamar's Proprioceptic Deep Tendon Reflex technique resolves a number of clinical questions that arise with use of the DTR in clinical practice'*

Non-pharmacological treatment options including superficial heat application, massage, acupuncture, and manual therapy, should be preferred in acute pain. If pharmacological treatment is required, nonsteroidal anti-inflammatory drugs and muscle relaxants should be preferred. In the case of chronic low back pain, non-pharmacological options should be used first as well. They include:

- remedial gymnastics
- multidisciplinary rehabilitation
- acupuncture
- stress control by maintaining concentration
- tai chi
- yoga

- motor control exercises
- progressive relaxation
- electromyographic biofeedback
- low-level laser therapy
- behavioural therapy
- cognitive-behavioural therapy, and
- manual therapy.

Therapeutic failure of the non-pharmacological approaches necessitates the use of drug therapy: nonsteroidal anti-inflammatory drugs (first-line therapy) or either tramadol or duloxetine (second-line choices). Opioid therapy may be used in exceptional cases, provided that the potential benefits outweigh the risks. (1)

The *OPTIMa Collaboration* recommendations for treatment of low back pain (Canada, 2016) compiled after pooling and analysing 13 Clinical Guidelines, which have been published in the last few years, include the following conclusions:

1. All patients with acute or chronic low back pain should be notified about the causes of the disease, the favourable prognosis, and the measures that the patient can use at home to alleviate the pain syndrome;
2. Patients with acute pain should be motivated to maintain their daily motor activities. The use of NSAIDs and / or spinal procedures improves the condition of these patients'
3. Treatment of chronic low back pain should include exercise, NSAIDs or paracetamol, acupuncture, manual therapy, and multimodal rehabilitation (as a combination of physical and psychological techniques); and
4. Manual therapy can produce an improvement in patients with herniated discs/radiculopathy.

Generally, most guidelines for treatment of non- specific back pain recommend educational patient programmes, maintaining physical activity, gymnastics, manual therapy, and NSAIDs as first-line drug therapy. (2)

In recent years, there has been increasing interest to one of the fields of manual medicine, osteopathy, that eventually resulted in its introduction into the list of medical specialties. Osteopathy as a method of rehabilitation with 'soft' technics of manual therapy is widely used all over the world in patients with musculoskeletal disorders and traumatic injuries. At the same time, certain attempts to apply this method for treatment of somatic disorders are neither sufficiently reasonable nor (even more so) evidence-based.

Prevention and rehabilitation

Prevention and rehabilitation are the most actively developing areas of medicine, whereas practical neurology mainly helps in diagnosis-making and selecting drug therapy, which has a rather limited potential. There are methods based on certain hypotheses that can be difficult to confirm or refute; however, their clinical efficacy is undeniable and has been demonstrated in studies conducted in accordance with the evidence-based medicine standards.

One example is the use of acupuncture or needle reflex therapy: large- scale studies have proved it effective This method has been included in many international recommendations for treatment of nonspecific lower back and shoulder pain, prevention of migraine and treatment of chronic tension-type headache, etc. When using functional neuro-imaging methods, an activation of opioid receptors induced by acupuncture is observed. (3) However, a large study that evaluated the efficacy of true or false (applied beyond any active points) acupuncture failed to demonstrate significant differences in efficacy thus indicating that this method, being undeniably effective, is however non-specific and in fact not different from placebo. (4)

No comparative studies of true and false acupuncture using functional neuro-imaging methods have been conducted. The situation with exercise therapy is similar: a 2017 *Cochrane* systematic review demonstrated the efficacy of various exercise therapy variants in patients experiencing pain at different sites and of various aetiologies; (5) the underlying mechanism is however unknown.

According to an IASP expert report, (2017) pain can be alleviated by training not just the muscles of the affected region but also some muscles remote from the source of pain. Training has an effect on all constituents of the biopsychosocial theory of pain. The largest body of evidence has been accumulated to support activation of the opiate systems as an underlying mechanism. Experimental models have shown that training exerts no analgesic effect when opioid receptors are blocked. Other findings have included changes in the regulation of the immune system, mitigation of vegetative dysfunction, activation of cannabinoid receptors, and central inhibition of pain. (6)

While the indisputable efficacy of manual therapy commonly practised throughout the world has seen this treatment method included in the majority of current back pain management guidelines, its theoretical justification is very conditional and largely lacking.

The Proprioceptive Deep Tendon Reflex (P-DTR)

One new development of rehabilitation is the method that is based on the use of the Proprioceptive Deep Tendon Reflex (P-DTR). This method is rather widely used in osteopathy and kinesiology but is known to very few neurologists. The method of proprioceptive deep tendon reflex (P-DTR) was developed by a practitioner, Dr. José Palomar (Guadalajara, Mexico). The author is an orthopaedist, traumatologist, and spinal surgeon. The P-DTR method has been used over the last few years in clinical practice by physicians of different specialties demonstrating good therapeutic efficacy.

P-DTR in Russian stands for proprioceptive-deep tendon reflex. The term itself describes the reflex arc, the afferent part of which are the impulses from proprioceptors (the receptors located in the muscle tissue, tendons, joint capsules), while its efferent response alters the functional activity of muscles. Unlike classical neurology, reflex arcs employed are connected with tecto-, rubro-, and vestibulo-spinal tracts that are poorly investigated and rarely considered in routine clinical practice. This method aims to produce differentiated effects on various receptor modalities (Golgi receptors, Pacinian corpuscles, etc.). The term P-DTR contains not only the physiological term, but also a set of therapeutic interventions directed towards normalisation of the nervous system functioning, which allows to use it as a synonym of the phrase '*P-DTR method*'.

Method

The method is basically an empirical one: the absence of a glossary of terms and objectification methods raises some tangible difficulties. Apparently, P- DTR is a method of neurological rehabilitation that is based on the principles of topical neurology, neurophysiology and biomechanics and applies the methods of manual therapy and applied kinesiology.

Treatment

P-DTR is a treatment system that is presumably based on the main principles of functioning of the nervous system with active involvement of a reflex feedback (deep tendon reflex in particular). Exposure of a reflex feedback to stimuli of various modalities is expected to affect the functioning of different systems of the patient's body (musculoskeletal system, gastrointestinal tract, endocrine system) as well as to correct biochemical and emotional disorders. The primary objective of the P-DTR method is restoration of normal reflex activity of the nervous system, including its motor and endocrine regulatory functions, leading to elimination of such pathological phenomena as pain and discomfort, as well as to increased amplitude of movements etc.

Advantages

The advantages of the P-DTR method is its non- invasive nature, safety, lack of pain and possibility of drug-drug interactions, as well as possibility of its use in patients with severe somatic diseases.

The P-TDR method can quite logically be explained from the perspective of the nervous system physiology: afferent information gets to the brain via a huge number of neural pathways starting with a certain type of receptors (Golgi receptors, Pacinian corpuscles, nociceptors) that, upon receiving a definite stimulus, transform it into electrical impulses getting to the CNS via specific neural pathways. Having received the information, the brain analyses it and produces motor and neuroendocrine responses based on the sum of all information received. The author of the method assumes that the realisation of the mechanism of action of P-DTR is pursued by the functional connection of the musculoskeletal system and tonic reactions with the mechanoreceptor apparatus.

The method itself is based on receiving of effects of different modalities, primarily the locomotor ones (change in muscle tone and strength) as a result of exposure of different body regions to absolutely various stimuli. The direct substrates of therapy are the receptive fields, the activity of which has been compromised by the dysfunction of receptors, proprioceptors in particular. Various stimuli are applied to activate different types of receptors: pain, applied using a needle; tactile, applied with a hand; and tactile pressure and mechanical stimuli that differ in exposure intensity and are applied to different regions of the patient's body.

In the course of developing the P-DTR method, Palomar discovered that the signal from a dysfunctional receptor changes if another (different) receptor is stimulated, and that these receptors are capable of regulating each other's activities. Thus the theory explaining particular mechanisms of the method emerged (so called paired associative stimulation theory).

Clinical explanation

Excessive afferent information comes to the central nervous system from paired receptive fields. A quantitative change of the information coming from a receptive field unavoidably results in a quantitative change of the information coming from another receptive field. In other words, any stimulus sent by a receptor to the central nervous system is compensated. In other words, any stimulus sent by a receptor to the central nervous system is compensated.

In its turn, the CNS is always 'on the watch' and constantly analyses the obtained information generating adequate motor and neuroendocrine reactions until the signal threshold is within so called 'green area'. That means that information is under control, it is regulated by the CNS and has sufficient resources for self-compensation, self- regulation and optimal everyday functioning. And if, according to the theory of P-DTR, the CNS receives dysfunctional, aberrant signals of high intensity from receptors, it will continue compensating these signals, however, by means of different functional receptor systems, which may result in unstable, abnormal biomechanics of the human body, limited range of movement, pain syndrome, insufficient energy, emotional disorders etc.

Palomar developed a unique system of different sensory 'inlets' into the nervous system leading to the required compensatory efferent 'outlets' in the form of motor or tonic reactions. The author classified different responses of the nervous system as functional and dysfunctional. Moreover, Palomar discovered that the receptors sending dysfunctional signals of high intensity could create compensation fractals or the compensatory 'tree' which would negatively affect the entire human body resulting in significant biomechanical, physiological, endocrine and immune disorders. Palomar also noticed that any dysfunctional signal affected the muscle stretch reflex (*myotatic reflex*) and, as a consequence, changed the muscle response assessed during manual muscle testing.

An aberrant signal sent by any type of receptors may cause functional weakness or hypertonus of both an isolated muscle and all muscles of the entire body. Any primary or secondary dysfunctional receptor has its associated muscle and is characterised by a specific inhibitory pattern depending on the CNS level where the signal block occurs. As soon the primary and secondary dysfunctional receptors have been found, the aberrant information may be 'reloaded' through simultaneous stimulation of both receptors and using the deep tendon reflex. Upon simultaneous stimulation of the receptive fields, the nervous system receives two signals compensating each other and allows the brain to 'reload' the aberrant information that was received earlier.

Thus suggests that the deep tendon reflex causes not only a local reflex, but affects the entire neurological response of the brain. He explains it by the fact that the reflex is a mechanism preventing CNS damage, and the brain may analyse afferent information immediately producing adequate response reaction. As a result of simultaneous stimulation of two receptive fields, the primary and the secondary, the brain receives the paramount information from these exact regions and clearly realises it. The use of the deep tendon reflex allows to reload the aberrant information that was received earlier and to bring it to the initial level, i.e. to reduce a high intensity signal to common level, so called 'green area', which makes the compensation of aberrant information by the brain unnecessary.

In most cases, the result can be seen and felt immediately; pain is eliminated or significantly reduced, the range of movements increases, the associated muscles acquire normal tone and the inhibitory pattern disappears. The method of P-DTR is a tool for finding and stimulation of dysfunctional receptive fields, determination of the primary control zone and the modulation of the flow of afferent information of various modalities followed by change in the functional state of the human body.

Thus, P-DTR affects different parts of the CNS, the impact on which according to the method of P-DTR is expected to result in the reflex response sufficient for functional activity normalisation.

History

On April 28, 2017 in the *Regional Municipal Budgetary Healthcare Institution 'Medical rehabilitation hospital'* in Smolensk, the conference '*Neuroreceptor Therapy. P-DTR in Functional Neurology. From Theory to Practice*' was conducted. The organiser of the conference was the *Department of Neurology, Physical Therapy, and Reflex Therapy* of the F*aculty for Additional Professional Education* of *Smolensk State Medical University*.

Theoretical basis of the method was described; its practical application (including presentation in specific patients) was demonstrated. The reports related to the use and studying of the of P-DTR method for treatment of pain were made by the Head of the *Department of Neurology, Physical Therapy, and Reflex Therapy* of the *Faculty for Additional Professional Education* of *Smolensk State Medical University* Professor Gribova NA; a postgraduate student of the *Department of Neurology, Physical Therapy, and Reflex Therapy* of the *Faculty for Additional Professional Education* of *Smolensk State Medical University* Korenevskaya IA, presented the results of a neurophysiological study '*Specifics of the electroneuromyography parameters in patients with pain syndromes of the musculoskeletal system before and after the use of the proprioceptive-deep tendon reflex method (P-DTR)'*, which had been conducted by the *Department of Neurology, Physical Therapy, and Reflex Therapy* of the *Faculty for Additional Professional Education* of *Smolensk State Medical University*. The author of the method Dr. José Palomar demonstrated P-DTR-related procedure of diagnosis and its therapeutic effects in patients and specialists willing to participate in the practical part. Among the participants of the conference, there were physicians of different specialties (neurologist, manual therapists, reflex therapy specialists, dentists, rehabilitologists) who had come from *Smolensk*, *Bryansk*, *Tver'*, *Roslavl*, and *Moscow*. There were young practicing physicians and physicians who had already proven themselves in professional activities.

The assistant professor of the *Department of Neurological disorders and Neurosurgery* of the *Medical Faculty*, the Head of the *Division of Treatment of Pain and Peripheral Nervous System disorders* of the *Clinic of Neurological Disorder*s (*University Clinical Hospital No. 3, Clinical Center of the Federal State Autonomous Institution of Higher Education "*The First Moscow State Medical University named after I.M. Sechenov' of the *Ministry of Health* of *Russia*), candidate of medical sciences Isaykin Alexey Ivanovich, who has been working for many years as the supervisor of the First Russian inpatient hospital unit specialising in treatment of pain syndromes was a guest lecturer at the conference.

Numerous papers, reviews, original articles were written and many scientific theses (both to obtain a degree of a candidate and a doctor of medical science) have been prepared since organisation of this Division in 1993 at the Clinic of Neurological Disorders of University Clinical

Hospital *No. 3, Clinical Center of the Federal State Autonomous Institution of Higher Education* 'The First Moscow State Medical University named after I.M. Sechenov'. This was done in collaboration with the employees of the Department who supervised the work of the Division. The employees of the Division, as well as members of research teams working at the Department have always been the frontline in studying and practical application of new methods of treatment and diagnosis of peripheral nervous system disorders and pain syndromes. Isaykin acted as an opponent and skeptic, who tried to analyse the presented data from the perspective of evidence-based medicine and methods of evaluation of clinical effects that are currently accepted in the modern scientific community.

In the course of presentation of practical methods of patients' examination and therapeutic treatment, along with the data from a neurophysiological study, the method, initially considered as having completely nonspecific opportunities, appeared quite convincing.

Conclusion

Obvious change in the muscle tone and the development of functional muscular weakness are confirmed by suprasegmental changes that are reflected in the muscular electrical activity, taking into account the results of the neurophysiological study.

Until recently, there were a lot of 'white spots' in the knowledge of control of muscle tone and segmental postural reflexes, as well as the reflex arcs and their activity under different conditions of functioning. Apparently, the method of P-DTR covers these exact gaps, which have not been hitherto the subject of interest of the clinical neurology, and at the same time, provides confirmation of the necessity of studying of segmental and subsegmental mechanisms.

Undoubtedly, the method of P-DTR deserves attention as a tool of practical neurology. However, it is still necessary to establish the process of training in fine mechanisms of exposure when applying P-DTR, to compare the applied exposure with current knowledge of the central nervous system physiology and to design and implement a comprehensive study in order to evaluate the stability of clinical effect and develop recommendations and principles of P-DTR application in clinical practice.

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