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The effect of rehabilitation with constant balance for the treatment of some cases of peripheral nerve inflammation of the feet in women aged (45-50) years

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ABSTRACT

The research aimed to prepare rehabilitation sessions with constant balance to treat some cases of peripheral neuritis of the feet in women aged (45-50) years, and to identify the effect of rehabilitation sessions with fixed balance at the top and area of the electrical signal (EMG) of the golf muscles, and to reduce the level of pain (V.A.S) in women with some cases of peripheral neuritis of the feet at the ages of (45-50) years, and the experimental approach was adopted by designing one experimental group, on a sample of (7) women from Dar Hospital Private nursing in Baghdad, all of them were deliberately selected by (100%) from this community, and the (EMG) test and the V.A.S test were adopted), and rehabilitation was prepared and applied with fixed balance experimentation for a period of (6) consecutive weeks, and rehabilitation treatment sessions applied daily without any interruptions during this period, and after the end of the experiment, which included pre-tests, application and post-tests for the experimental research group, the results were extracted with the (SPSS) system. To be the conclusions and recommendations that the rehabilitation with fixed balance proved its suitability for the treatment of some cases of peripheral neuritis of the feet in women aged (45-50) years, and the application of rehabilitation with fixed balance has a positive effect in increasing the top and area of the electrical signal (EMG) of the posterior golf muscles for both the right and left leg and reducing the level of pain degree V.A.S.) for the feet when qualifying some cases of peripheral neuritis of the feet in women aged (45-50) years, and it is necessary to adopt sports technology to measure the safety of nerve and muscle functions by means of the (EMG) device and track the level of progress in the qualifying sessions for their high objectivity in measurement during movement, and the principle of gradation must be followed along the length of time according to the movement of balance when qualifying with constant balance to treat some cases of peripheral neuritis of the feet in women aged (45-50) years.

Research problem and importance:

Some women who are not sick with diseases of the age face some cases of peripheral neuritis despite taking treatment with non-steroidal analgesics and others, but the weakness of the leg and palm muscles causes them pressure on the nerve and inflammation, which shows them cases of fatigue when standing or practicing their daily work, and considering that the locomotor system includes all of the nerves, muscles, bones and joints, and the dominant on this motor system is the nervous system as it is known, and the weakness in the work of the nerves It confuses movement and causes pain in cases of inflammation.

"The functional anatomy of the nervous system indicates that the nervous system connects the nerves of the brain, spinal cord and central nervous system to the nerves in the extremities of the body, and its various parts, such as the arms, hands, feet ... And others, and inflammation as a concept means a defect, and when it occurs in the cells of the nervous system, especially (Schwann sheath), it extends to the extremities of the body that cause damage (myelin), which affects the physiological support to maintain the ionic balance of the synapses, and the matter may worsen to damage or complete damage in them, and this is what disturbs the function of the nerves that appear clear when they start sending wrong pain messages to the brain without any reason for this pain, or may not send Any messages of pain when there is an actual cause of pain, is a disease that includes more than 100 different types of this disease." (Abdel-Gawad, 2016), p. 11)

Considering that "these indicators may occur a lack of gel material for cartilage between the bone endings, which affects the exit of the pulposal nucleus to the outside and cause pressure on the nerves numbness and numbness of the limbs in the upper penalty, which is often accompanied by other changes such as the sensation of pricking pins, needles, numbness and burning, and the person may feel weak and to varying degrees and then the injured person does not return to his normal state that he was in before the injury." (Bakri, 2020, p. 133)

"Stress, whatever its sources, will lead to fatigue of the receptors and senses associated with the nervous system, and through stress, negative effects on the activity of the central nervous system are obtained." (Hassan, 2009, p. 34)

Also, "Among the causes of these inflammations of the peripheral nerves of the joints are multiple, including certain infections, injuries, specific diseases, or genetic diseases. And others, and it has the most common symptoms in those affected by it, the most important of which is the feeling of numbness, numbness and tingling in the hands and feet, or feeling as if he is wearing tight gloves or tight socks, thinning of the skin, a decrease in blood pressure, and the fall of objects constantly from the hands when carrying, excessive sweating, digestive problems such as diarrhea or constipation, as well as sexual weakness, especially in men, and specialist doctors faced problems in directing the injured to exercise that can be applied to reduce the symptoms of these infections and recover as long as they They invite them to exercises, and here comes the role of scientific studies in sports rehabilitation to support and support the efforts of therapists with rehabilitation exercises appropriate to the abilities and capabilities of the injured, as the increased interest in rehabilitation exercises is no longer an emergency for humanity so that some therapeutic schools rely on them completely in treatment to return the injured athlete to the field, and return the non-athlete to daily activities. (Abdel-Gawad, 2016), p. 11)

This confirms the existence of a difference between the resulting neuropathies as symptoms that cross as side effects of modern diseases as a result of diabetes or nutritional deficiencies, which appear clearly in the feeling of paresthesia of the skin in the extremities and nerve weakness, and between inflammation of the peripheral nerves of the feet, which result from muscle weakness, especially the leg muscles, which are common cases that differ from peripheral neuropathy.

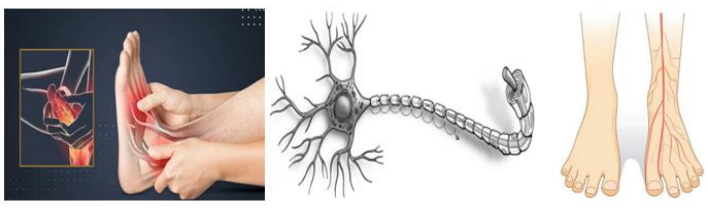


Figure (1) shows the nerves, the body of the nerve cell and the site of peripheral neuritis of the foot

Thus, peripheral neuritis infection can be defined as a defect that affects the work of the nerves that come out of the brain and spinal cord, especially those connected to the extremities of the body such as the palms of the hands and feet, and this type of inflammation causes weakness or loss of normal nerve function, leading to pain, excessive sensitivity and weakness in the work of the limbs in the patient. (Al-Shafi'i, 2024, p. 127)

In general, "it begins with muscle contraction from motor neurons, after which the systolic processes begin, and when the nerve signal reaches the end of the motor nerve, the end of the nerve secretes a neurotransmitter called acetylcholine, which spreads through the neuromuscular fissure to bind to its own receptors located above the peripheral plate area, which leads to an increase in the permeability of sarcomier to sodium ions, and as a result, it loses polarization (Depolarization).) and this, in turn, leads to the onset of muscle contraction processes." (Abdel Fattah, 2003, p. 196)

"The level of control moves from the spinal cord to the motor cortex, so the complexity of the movement increases from simple reflexes to complex movements, and the motor response to more complex movement patterns arises in the motor cortex." (Abdul Khaliq, 2014, p. 328)

"The nerve impulse or nerve impulse is the voltage of the action or electrical change in the nerve membrane, which moves along the nerve deriving energy from its source in the neuron and its speed ranges between (90-100) meters / second, but in the fibers sheathed with myelin, its speed is ten times, the greater the diameter of the nerve fiber, the faster the nerve impulse." (William, 2006, p: 35)

"Skeletal muscles contract in response to a neural signal from the motor neuron and do not respond directly under the influence of hormones, unlike heart muscle and smooth muscles." (Sajit & Ali, 2017, p. 62)

Also, "the intensity of muscle contraction depends on the intensity of the stimulus, since the muscle fibers that make up the muscle are characterized by different degrees of excitability), as some of them contract in response to a weak stimulus, and this means that these fibers have high degrees of excitability, and others contract muscle fibers for a stimulus of higher intensity than the first, and this means that these fibers have a relatively low degree of excitability. compared to the first type." (Jalaluddin 2007, p. 85)

Also, "the nervous system is the means of the body that establishes the link between the members of the sense and reception and response to the events of the internal and external environment, which is the center of thinking, decision-making, initiation and control of actions, it performs its function in dominating and controlling all parts of the body and is responsible for any movement issued by the body, starting from eye movement and ending with large muscles, and the nervous system has a major role in motor performance at all levels." (Kammash, 2008, p. 210)

" Neuromuscular performance is a complex ability that requires good levels of other fitness components, and all sports and exercise events share a need for a varying amount of coordination and coordination of movements in an ever-changing environment, and despite the complexity and synaptic processes associated with neuromuscular compatibility, the human brain is able to easily integrate information coming through sense organs, muscles and joints." (Jantzen & Other, 2008, p: 13)

"In normal man, there is a balanced coordination and coordination of the activities of the various sections of the nervous system, and the outcome of these neurological activities generates at any moment motor responses that express the intensity and direction of this result, in exercise the role of the senses and the information they transmit to the brain cannot be neglected, as well as the sensors spread in the skeletal muscles (Kolgi tendon bodies and muscular spindles) because of their preventive and informational role, as well as skin sensitizers, and that the efficiency of these receptors helps to facilitate the movement of the joint at the maximum range, as well as About the vestibular equilibrium device and the reflexes for maintaining balance, which perform reverse action in the muscular work in the

other part corresponding to the work, such as cross-stretching reflexes, pulling and bending, as well as bioelectrochemistry that explains its mechanism of action (acetylcholine, sodium and potassium ions... and others)". (Nasiri and Naji, 2015, p. 66)

The researcher also believes that balance in its various forms is one of the most important clinical indicators of the safety of the nervous system, and can be inferred by it for neuromuscular control to save strength, and can be invested in two directions in sports rehabilitation research are as an influencer and as affected.

Static equilibrium is defined as " the ability of an individual to maintain his balance in a stationary position by maintaining the center of gravity within the rule of equilibrium." (Ahmad Wakzar, 2015, pp. 177-178)

As for the balance tools, they are defined as "unstable bases and stabilizations aimed at raising the information of the vestibular apparatus to feel unbalanced to push the body to change its positions with muscle contractions that tighten its strength to avoid falling." (Collins & Other, 2007, p: 397)

It is also defined as "any rigid or flexible instrument in which the position of the body is unbalanced, either by a lack of equilibrium base or by increasing the height of the resting on it". (Milner, 2012, 109)

"Balance tools differ in terms of the type of material or in their effect on the balance of the body, and they are types of sponge tools, such as a thick and highly malleable rug, which makes the individual feel the looseness of its flat surface, rubber tools, which are in the form of figures, and plastic and solid wooden tools with a narrow base and a wide surface." (Frizzell & Dunn, 2015, P: 404-405)

"The resistance training still converges with the characteristics of the symptoms mentioned for these infections in cases of peripheral nerve inflammation, so obtaining muscle sufficiency for contractions requires searching for what tightens them on the other hand, including muscular tones to tighten the muscles of the body, which can be obtained by balance, as the ability of balance in general is of two types: fixed balance, which means the

ability that allows to maintain the stability of the body without falling or vibration when taking certain positions, and balance. Kinetic means the ability to balance during a particular motor performance." (Al-Sawy and Al-Jourani, 2013, p. 35)

There are also "caveats to the use of balance tools in rehabilitation, which are "not to use them with a significant weakness in the muscular ability of the injured and in the case of myasthenia, until they reach a level of muscle strength that enables them to synergy muscularly, and not to use high-level injuries in the limbs at the beginning of rehabilitation programs, and to determine the time of their use gradually in increasing the duration according to the development of the level, avoiding complex ones and exaggerated difficulty, and emphasizing the diversity of exercises that allow the exchange of work of muscle groups."(Olowu & Atejuyo, 2010, p: 216)

With this presentation of scientific sources, the research problem is determined by the observation of the researcher by virtue of his academic work in the field of sports rehabilitation, that women with some cases of peripheral neuritis of the feet aged (45-50) years who visit the Physiotherapy Division at the Private Nursing Home Hospital and receive drug and physical therapy in it, need physical rehabilitation that strengthens the work of the muscles of the legs and the muscles of golf specifically to relieve pressure on the nerves that cause pain in the feet to contribute with therapists in accelerating the process of recovery and restore their normal lives.

Research Objectives:

1- Preparing rehabilitation sessions with constant balance to treat some cases of peripheral neuritis of the feet in women aged (45-50) years.

2- To identify the effect of rehabilitation sessions with constant balance at the top and area of the electrical signal (EMG) of the golf muscles, and reduce the level of pain (V.A.S.) in women with some cases of peripheral neuritis of the feet at the age of (45-50) years.

Research hypothesis:

1. There are statistically significant differences between the results of the peak and electrical signal area (EMG) tests of the golf muscles, and the degree of pain (V.A.S) before and after the experimental research group.

Research Limitations:

Human limits: A sample of women aged (45-50) years who attend the Private Nursing Home Hospital / Physiotherapy Division.

Time limits: for the period from (13/2/2025) to (27/3/2025).

Spatial boundaries: Baghdad / Medical City Department / Private Nursing Home Hospital / Physiotherapy Division.

Research Methodology and Field Procedures:

Research Methodology:

The experimental research method was adopted by designing a single experimental group with pre- and post-testing.

Research community and sample:

The limits of the research community were limited to women aged (45-50) years who attend the Private Nursing Home Hospital / Physiotherapy Division in Baghdad without cases of paraproctopathy resulting from diseases of the age and malnutrition after confirming their analysis in this hospital as they are from the category of most ages who visit this hospital, and their total number is (7) injured, all of them were deliberately selected by the method of comprehensive inventory of the research sample by (100%) of their community of origin, and before starting the experiment, the researcher verified their homogeneity In the degrees of some extraneous variables to maintain the internal integrity of the experimental design, as shown by the results of Table (1):

Table (1) shows the results of homogeneity of the degrees of the affected research sample in some extraneous variables

orsion fficient	andard viation	ithmetic mean	mber	Unit of asurement	Horse-riding variables
0.235	1.134	18.57	7	day	Age of injury
0.415	1.988	47.43	7	year	ıronological age

0.772	1.069	22.14	7	kg/m2	ody Mass Index (BMI)

(BIM) = body weight (mass in kg) \ square body length in meters, torsion coefficient between (+1)

Testing and measurement:

The researcher adopted the opinion of the neurological doctors from the consultants in the hospital under research in determining the measurement tools for the current research, which was represented by the scale of the degree of pain (V.A.S) listed from (1-10) degrees to measure the degree of pain after standing according to the ability of the injured on the tips of the toes, as this measurement is done after (2) seconds on this type of standing, and the device (EMG) type (Myo trace 400) American-made transmitter (Bluetooth) Using two clippers for each of the posterior golf muscle of both the right and left legs, the results of the EMG signal are obtained and analyzed with the program (Myo Research XP 1.06.67) stored in a laptop, as after synchronizing the end of the infected to the stand on the tips of the fingers with a digital imaging camera type (SONY) does not increase quickly (75 images. seconds), to take the reading of both the top and the area of the (EMG) signal. For each of the two muscles, i.e. one test was performed, which is balance, to measure the degree of pain of the feet and the electrical signal of the posterior golf muscles for each of the right and left legs for each patient with an appendix (1).

Fixed Equilibrium Qualification Preparation Protocol and Applications:

After making the basic preparations for these rehabilitation sessions in adopting the literature and applications that deal with this injury, the rehabilitation sessions were prepared and the research experiment was initiated according to the following procedures:

- The experimentation continued for (8) consecutive weeks, and with rehabilitation therapy sessions with these exercises daily without any interruptions during this period.
- Medical recommendations have been adopted to accompany the application of rehabilitation sessions, including avoiding alcohol of all kinds, avoiding smoking, not overeating the diet, wearing appropriate clothes that are not tight, and wearing medical shoes.

❖ The content of the exercises in the fixed equilibrium training included more dynamic movements to stand on the fingertips without tools, and with different simple balance tools, but most or most of them were without tools, (Appendix 2).

❖ The principle of continuity of application was adopted on a daily basis without interruption and the duration of the session is (30) minutes at a rate of (4) rehabilitation exercises in each session, as its components were distributed as follows:

✓ The first and second weeks: standing on the feet while they are flat without any lifting of their heels without tools, for a period of (15-30) seconds and on a daily consecutive basis with repetitions amounting to (10) repetitions × (4) groups, with complete comfort between them appropriate to the privacy of the injured.

✓ The third and fourth weeks: Women with balance stand on the tips of the fingers with balance tools on the tips of the toes for (3) seconds and on a daily consecutive basis with repetitions amounting to (15) repetitions × (3) groups with complete comfort between them.

✓ Fifth and sixth weeks: Balanced women stand on the tips of the fingers without tools for a period of (4) seconds and on a daily basis in a row with repetitions amounting to (25) repetitions × (2) two groups with complete interstitial comfort.

❖ The research experiment began by applying (EMG) and (V.A.S) tests on women with some cases of peripheral neuritis of the feet aged (45-50) years in the experimental research group of (7) infected at nine o'clock in the morning on Thursday (10/2/2025).

❖ Fixed balance rehabilitation was applied to the experimental group of (7) injured, during the period of receiving hospital physiotherapy, for the period from Sunday, corresponding to (16/2/2025) until Thursday, corresponding to (27/3/2025), and after completing the application of the fixed balance rehabilitation vocabulary, and on the same day, after (3) hours have passed for complete rest for the injured women, the (EMG) and V.A.S) tests were applied in the same conditions as the tribal tests, considering that the coming days coincide with the blessed Eid Al-Fitr holiday.

After the completion of this experiment, the data were processed automatically using the SPSS system by extracting the percentage values, mean, standard deviation, torsion coefficient, and t-test for correlated samples.

Results:

Table (2) shows the results of the pre- and post-tests of the experimental research group

gnific nce	Statistical treatment of comparison between pre- and post-tests						esting	Tests and unit of measurement		
	Sig)	(i) loptio of the ovena t on	H	P	± p	oing to				
D	.000	7.798	.035	.234	.027	.437	uthern	Peak icrovolt s)	ight golf uscle	Electrical Signal (EMG)
					.016	.671	away			
D	.000	.364	.028	.078	.026	.251	uthern	Area icrovolt .tha)		
					.005	.329	away			
D	.000	3.276	.017	.115	.014	.412	uthern	The ummit licrovol ts)	Left golf uscle	
					.009	.527	away			
D	.000	7.019	0.01	.062	0.01	.198	uthern	Area icrovolt .tha)		
					.005	.259	away			
D	.000	6.291	0.69	.857	.488	.29	uthern	Degree of pain V.A.S) (degree)		
					.535	.43	away			

The differences are a function at the level of significance (0.05) and the degree of freedom (6) when the degree (Sig) is less than (0.05)

Discussion:

From reviewing the results in Table (2), it is clear that the dimensional values of the five tests represented by the apex and signal area (EMG) for each of the golf muscles in the legs and the degree of pain (V.A.S) of the feet improved from what they were in the pre-tests of the experimental group patients, to give these results that the increase in the value of the peak that the electrical activity (EMG) of the contraction of all the golf muscles is at its peak, and the increase in the area of propagation of the signal (EMG) It means that the

muscle increased the duration of the start of feeling tired with this contraction, and that the reduction in the level of pain (V.A.S) of the feet came as a result of improving the full function of the musculoskeletal system and the researcher attributes the emergence of these results to the positive role of rehabilitation with constant balance, which helped increase the ability of the injured to restore the adequacy of the back golf muscles, which can be contracted toes without stress leading to pain in the area of the feet, as it is a fixed contraction when extending the toes in periods of time Short not exceeding (5) seconds in the case of lifting the heels of the feet helps in improving the contractile processes of the muscles and then strengthen them with these repetitions as well as the rehabilitation of the feet while they are flat without any lifting of their heels and without tools, for a period of (15-30) seconds, which helped the injured women overcome the obstacles of pain when standing that were caused by cases of inflammation of the peripheral nerves of the feet in this category of women, considering that the movements included in the rehabilitation received internal reactions that helped to improve the mechanism of work Neuromuscular, as well as relieving pressure on the nerves as a result of strengthening the muscles in the fixed balance positions included in the rehabilitation exercises and gradation at each stage, which extended two weeks each, as well as good planning and application of this rehabilitation to suit the age and sex of the sample of women aged (45-50) years.

As it is "to maintain balance, directing commands towards nerve impulses from the cerebral cortex is towards the muscles that increase the body's control of stability in abnormal conditions of balance, and in fact the muscle tension continues to contract in some muscles to maintain balance or save the people without feeling it unless we focus on it or increase this tension as required to ensure a sense of balance, and repetition with different situations using means of improving balance helps to increase our ability to Quickly take the equilibrium position if we are faced with unstable conditions of strength."(Bronner & Other, 2013, P 366)

It also "exercises to strengthen the muscles of the body in different positions to increase balance by means of repetition of those positions and by equalizing the moving moments." (Jack, 2016, P: 11)

"Anyone who leads to a stable or slippery surface must train on equally unstable surfaces to improve performance, strengthen muscles and reduce the risk of injury." (Hamza, 2020, p. 117)

"The greater the electrical excitation exerted on the muscle, the greater the force of contraction and the recruitment of the largest possible number of motor units, if not all, because involuntary electrical stimulation of muscles differs from voluntary contraction in this capacity, i.e. the electrical excitation of muscle stimulation is different from voluntary contractions." (Al-Bishtawi and Al-Khawaja, 2005, p. 330)

"As the electrical excitation passes effectively along and below the sarcolema, the calcium pump releases calcium from the sarcoplasmic reticulum to the sarcoplasm, and then acts later to activate and shrink the capillary row, this stimulation begins with the arrival of the nerve stimulus to the muscle membrane through the motor terminal (motor unit) (Ira & Judy, 2008, p: 107).

Also, "after the arrival of the signal and the secretion of acetylcholine, sodium ions are depleted and a potential difference occurs, which runs along the membrane of the muscle fiber in the same way that the action efforts apply to the membranes of nerve cells, and at this moment the stimulation of the calcium ion begins to release, which was stored in the network, starting to the muscle fibers, and calcium ions generate attractive forces between the actin and myocene filaments, which leads to the formation of transverse bridges and then sliding on each other, and after it became The high-permeability membrane of sodium ions, which lasts for a thousandth of a second, the sodium channels begin to close and open more potassium channels than their normal state, and then the rapid diffusion of potassium ions outward, called membrane repolarization stage, where calcium ions are pumped back into the sarcoplasmic network to begin a relaxation state." (Gyton & Hall 2020, 91)

Also, "neuromuscular performance is of great importance, because its development is one of the main goals of physical education, and the importance of motor compatibility is not determined in sports activity only, but extends to the general life of the individual, as all the requirements of public life require a certain amount of compatibility between different parts of the body, and neuromuscular performance is the ability of the individual to integrate more than one movement using more than one member of his body in one frame and smoothly and with high accuracy." (Al-Lami, 2006), p. 29)

"Physical therapy with sports rehabilitation is an art and science that contributes to the development of health and the prevention of disease by understanding the movement of the body and it works to correct and mitigate the effects of disease and injury, and when the injury occurs, we strive to treat and rehabilitate it and return to the stage before the injury." (Bakri, 2020, p. 133)

"Those who undergo structured and time-bound programs, objectives, modalities, and an acceptable interpretation of this is based on the physiological responses of each of the muscle fibers recruited for functioning, neurostimulation, and the use of energy sources." (Abdul Zaher, 2014, p. 47)

Conclusions and recommendations:

1. Fixed balance rehabilitation has proven suitable for the treatment of some cases of peripheral nerve inflammation of the feet in women aged (45-50) years.
2. The application of constant equilibrium rehabilitation has a positive effect on the apex and area of the electrical signal (EMG) of the posterior golf muscles of both the right and left leg and reduces the level of pain (V.A.S) of the feet when rehabilitating some cases of peripheral neuritis of the feet in women aged (45-50) years.
3. It is necessary to adopt sports technology by measuring the safety of nerve and muscle functions by means of the (EMG) device and tracking the level of progress of the qualifying sessions for their high objectivity in measuring during movement.

4. The principle of gradation over the length of time according to the movement of balance must be followed when using fixed balance tools to treat some cases of peripheral nerve inflammation of the feet in women aged (45-50) years.

References:

5. Ahmed, Mazen Abdulhadi and Kazar, Mazen Hadi. (2015). Advanced readings in learning and thinking: an introduction to kinetic sciences for students of colleges and institutes of physical education. Babylon. Scientific Books House .

6. Bishtawi, Muhannad and Khawaja, Ahmed. (2005). Principles of sports training. Oman. Wael Publishing and Distribution House.

7. Bakri, Muhammad Qadri. (2020). Sports rehabilitation, sports injuries and first aid. Cairo. Book Center for Publishing.

8. Jalaluddin, Ali. (2007). Principles of Physiology. Cairo. Pharaohs for printing.

9. Hassan, Adel Turki. (2009), Principles of Sports Training. Najaf. Dar Al-Diaa for Printing and Design.

10. Hamza, Amr Saber. (2020). Functional training in the sports field (Al-Fasha training). Cairo. Dar Al-Fikr Al-Arabi.

11. Sajit, Hussein Manati and Ali, Ahmed Farhan. (2017). Physiology of physical exertion. Babylon. Dar Al-Sadiq Cultural Foundation for Publishing and Distribution.

12. Al-Shafi'i, Olfat. (2024). Rehabilitation of injuries and maintenance of healthy posture. Alexandria. Dar Al-Wafa for Publishing and Distribution.

13. El-Sawy, Hisham Mohamed and Al-Jourani, Hala Ibrahim. (2013). Strength breeding. Alexandria. Modern University Office.

14. Abdul Gawad, Abdul Basit Siddiq. (2016), New in the treatment and rehabilitation of sports injuries. Alexandria. Mahi Publishing and Distribution House.

15. Abdul Khaleq, Hamed Ahmed. (2014). The science of the study of mathematical movement. Cairo. El Meligy Press.

16. Abdul Zaher, Muhammad Mahmoud. (2014). Physiological foundations of training load planning (steps towards success). Cairo. Modern Book Center.

17. Abdel Fattah, Aboulela. (2003). Physiology of training and sports. i(1). Cairo. Dar Al-Fikr Al-Arabi.

18. Pincers, Joseph Lazem. (2008). Human physiology. Oman. Arab Community Library for Publishing and Distribution.

19. Al-Lami, Abdullah Hussein. (2006). Fundamentals of motor learning. Diwaniyah. Moayed Art Printing Collection.

20. Al-Nasiri, Aide Sabah, and Mahmoud, Ahmed Naji. (2015). Exercise physiology. Baghdad. Warraqoun Library.

21. Arthur C . Guyton & John E. Hall. (2020); Textbook of medical physiology : 17thed, Philadelphia, PA , USA: Library of Congress Cataloging-in-Publication.

22. Bronner S, Ojofeitimi S, Rose D. (2013). Injuries in a modern dance company. Am J Sports Med, 31, P: 365–373.

23. Collins, N., Bisset, L., McCool, T. and Vicenzino, B; (2007). Foot orthoses in lower limb overuse conditions: a systematic review and meta-analysis, Foot and Ankle International, 28: P: 396–412.

24. Frizzell La, Dunn F. (2015). Biophysics of ultrasound, in Lehman J (ed.): Therapeutic Heat and Cold, fourth ed. Baltimore, MD, Williams and Wilkins.

25. Ira Wolinsky & Judy A. Driskell (2008). Sports nutrition: energy metabolism and exercise: New York, Library of Congress Cataloging.

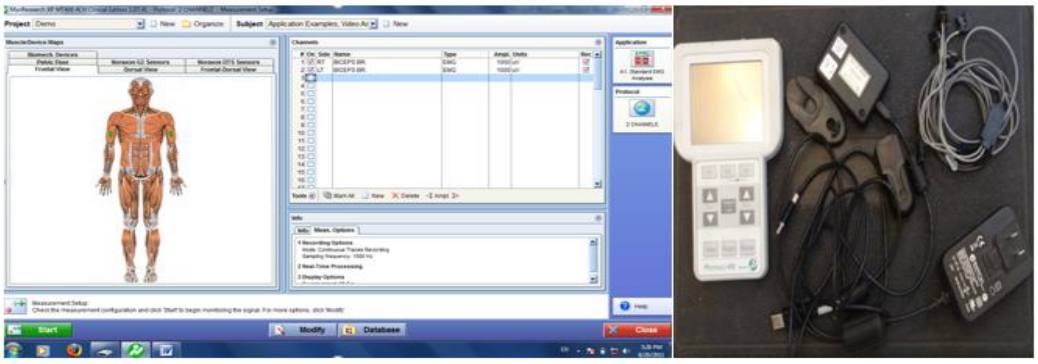
26. Jack Wilmore. (2016). Physiology of sport and exercise, 6ed, Human Kinetics, U.S.A.

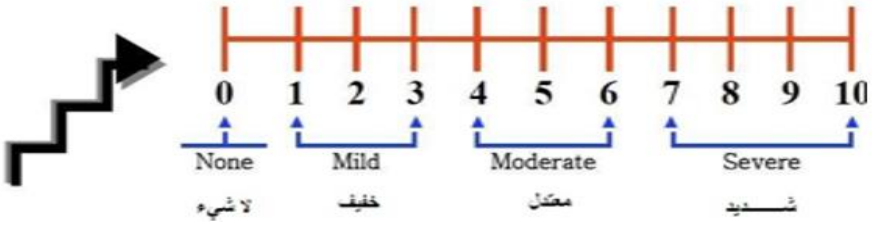
27. Jantzen, K., Oullier, O & Kelso, J. (2008). Neuroimaging Coordination Dynamics in the Sport Sciences, (Electronic Version), Methods, 45, journal homepage.

28. Milner, C.E; (2012). Motion analysis using online systems, in C. Payton and R. Bartlett Biomechanical Analysis of Movement in Sport and Exercise: The British Association of Sport and Exercise Sciences Guide, Oxon: Routledge.

29. Olowu R A ; Atejuyo O,(2010); Determination of heavy metals in fish tissue .water .and sidiment from Epe and Badagry Lagoons . Negeria , E . Journal of chem. Vol (7) No (1), P: 215-222.

30. William F. (2006). Ganong, Review of Medical Physiology; Hill companies.





Appendix (1) shows pictures of the EMG device , a system window in the calculator, and a pain measurement form