PHYSIOTHERAPY AS AN AID IN DIAGNOSIS, PROGNOSIS AND TREATMENT

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Physiotherapy, as the name itself states is the use of the physical remedies in the treatment of disability or disease or in simple words it can be defined as the treatment through the physical agents or means; like light, exercises and massage etc. Perhaps too much stress is laid on the various physical means, and insufficient attention paid to what the term therapy implies. The dictionary gives the definition "tending to cure the disease". In fact in physiotherapy the words 'tending to' are apt. Most often, the condition is such that cure, in its true sense of the word, that is, complete restoration of full function, is not possible. Well, no doubt, the job of the physiotherapist is to rehabilitate—"restore to right privileges, reputation" (Tidy). In other words, to bring the patient to the point where he can once again have his place in the society as an independent member. Actually speaking, it is mainly the re-education of the movement where physiotherapist is concerned. For thorough understanding a thorough study of the mechanics of the movements is a must, but as our topic for to-day is different. it does not come within the province of the proposed article.

1. Before coming to our main point: how physiotherapy is an aid in diagnosis. Let us give bird's view to what evaluation of the patient is? In the course of medical advance a standard procedure has been evolved to facilitate the documentation of the medical history of the individual patient. Mind well for taking history, which form an important part of evaluation of the patient, the physician must guide his patient, without unduly influencing or prejudicing him, to obtain the necessary information. It is where you need great patience, skill and tact, which are of paramount importance.

From physiotherapy point of view in Rehabilitation medicine we are primarily concerned with the physical examination of the patient. And there is no doubt this will contain all essential elements of the examination used in clincical practice which are—identical data—name, age, address, vocation etc; chief complaints; history of present illness, history of past illnesses, family history, habits; vocational history; psychological history; systemic review. However, strong emphasis must be laid on an extensive neurologic and orthopaedic survey, that is because of the nature of the specific problems in physical rehabilitation. The most guiding principle in the physical examination of the disabled patient is that all informations concerning the patient's functional capacity along with the conventional anatomic and pathologic state should be obtained.

For the full satisfaction of the physician dealing with the physical disabilities specific diagnostic measures as testing of muscle strength; range

of motion of joints, electrical testing of the nerves; electromyographs and evaluation of the ability to perform the activities of daily living etc. prove to be the important measuring gauze for complete diagnosis.

Testing of muscle strength—The assessment of the impaired musculature is indispensable to a good disability diagnosis. Since long both the clinicians and the pathologists have been working on methods which are accurate and yet simple enough for clinical use. A great number of laboratory methods have been designed but, sorry to say, most of them are too complicated and cumbersome which require a number of instruments to be used for. For objective evaluation of the muscle power, now-a-days, simple dynamometers and ergometers have been devised. But subjective evaluation of muscle strength is the one which is mostly relied by the physicians of to-day.

No doubt, this method too, like other subjective techniques possesses a number of weaknesses and is necessarily rough one, but its application in the course of long years has lent it such a degree of accuracy that now it can safely be recommended to serve the purpose. It is Lovett who first of all in 1916, used the most modern diagnostic method in testing the patients with poliomyelitis. This method briefly consists of applying various degrees of resistance. Afterwards this test has undergone a number of technical improvements.

These functional tests are based on the gravity and the key of this method is as follows:—

Zero (0)—indicates that no contraction felt or seen.

Trace (1)—indicates that muscle contraction can be felt but cannot produce movement.

Poor (2)—indicates that movement in gravity eliminated position is possible but cannot function in against gravity position.

Fair (3)—Indicates—that movement against gravity is possible.

Good (4)—indicates that muscle functions against gravity is well as some outside resistance.

Normal (5)—indicates that it can overcome a great amount of resistance than a good muscle.

Briefly the procedure is as follows (Lovett)—

First, the patient is placed in a test position, which obviously varies with muscle or muscle group to be tested. Then he is asked to move his muscle through its full range of motion. According to the response grading is done.

This method will not give a reliable picture of strength of the spastic muscles. The presence and degree of spasticity is indicated by S or SS and the extent of contracture is indicated by C or CC in the patient's record.

In another method of testing muscle strength force is applied to "break' a test position, assumed by the patient.

To avoid the inaccuracy of the method it is desirable that the same therapist must do the check up every time, which should be done time to time to note down the progress of the muscle power.

It is obvious that muscle testing is important in diagnosis of neuromuscular diseases. Characteristic segmental or 'pattern' type weakness, even of a mild degree is significant and leads to the diagnosis of such conditions as muscular dystrophy, amyotrophic lateral scelerosis and syringomyelia.

Children with easy fatique, minor end of the day, limp in gait or postural deviations, in whom we find weakness of spotty nature distributed in one or more bodily segments, will lead us to the diagnosis of previously unrecognised polio. Patients with fairly advanced 'idiopathic scoliosis' on careful examination and muscle testing, will often show moderate weakness in the extremities (including lowers) which is not secondary to the scoliosis itself. Early diagnosis of muscular dystrophy often depends on accurate muscle testing. Patients with this disease are often taken from physician early in their course with complaints of easy fatique, and minor gait disturbances. At this point characteristic proximal weakness should give us the clue to diagnosis, though biopsy and electromyography may assist in confirmation.

The level of the lesion in peripheral nerve trauma can be quite accurately ascertained by muscle testing. Muscles which receive the innervation below the lesion will be partially or completely involved, depending on the severity of the lesion. Muscle testing will aid in diagnosis more than sensory pattern, which can be quite variable.

In the milder cases of cerebral palsy where spasticity was undiagnosed in the early years, but muscle testing also proves to be an aid in its diagnosis. Objective reflex changes may be normal and the developmental examination equivocal in a patient with mild birth hemiparesis, one more symptom which may be present is increasing difficulty in walking due to developing heel and contracture secondary to weak dorsiflexors of the foot. Its presence may be discovered early by muscle strength.

Post fracture patients frequently have convalescence and poor functional recovery, with continued or developing joint pain, due to muscle weakness and limited motion of adjacent joints following removal of cast. Remeber well—appropriate treatment directed at the weakened muscles and joints will often rapidly return the patient to full activity and work.

Hysterical weakness can usually be diagnosed from the manner of the performance during a manual muscle test, the patient will make only insufficient or passive attempts to the involved part.

2. Evaluation of treatment and the course of the diseases—only repetitive check up will help to do so.

3. Progonosis—Muscle testing does help in the prognosis of certain diseases, for example, poliomyelitis etc.

4. It also gives an idea whether need for functional and assistive apparatus is there.

5. And finally to know the evaluation for surgical correction.

Testing the Range of Joint Movement—

Range of motion—the extent of the movement possible in a particular joint, is measured to assess the range of joint movement possible in that joint, and so to know the degree of limitation. Since in many musculoskeletal diseases, the range in which the joint is able to move is impaired and degree of impairment has an important bearing on the patient's functional capacity, measurement of the angle of motion becomes important as a cornerstone in the diagnosis purposes.

The assessment of range of motion also is of two types—subjective and objective. For objective method we have got a number of modalities but it requires a number of equipments, time and are expensive, so it is better to use the subjective method, which is mostly in use, for gross orientation. In case some definite limitation is to be detected one of many objective methods may be used.

For subjective method goniometor is the simplest instrument for measuring the range of motion. It consists of two shafts which are joined at a scale with a bolt, which allows one of its bars to move freely around the scale. The extent of movement can be read from the scale, by placing the joint or centre of the instrument over the centre of the joint and the fixed bar along the proximal part while free bar will superimpose the part being moved.

Electrodiagnosis—In its broadest sense, electrodiagnosis includes all diagnostic procedures based on the introduction or removal of electricity from a living subject. Here we shall limit ourselves to the introduction and removal of electric currents to the clinical application of electroneurophysiology.

In physical medicine and rehabilitation diagnostic evaluation is used to investigate the integrity of some portion of the neuromuscular system and electrodiagnostic procedures are applied to establish objectively and to evaluate (i) whether an organic neuromuscular lesion exist (ii) the nature of the defect (iii) the extent of the lesion—partial or complete, and (iv) the prognosis for spontaneous recovery or the need for surgical intervention. Most often the electrical tests are employed, with their greatest usefulness, in the diagnosis and prognosis of peripherial nerve lesions. They are, however, of great importance and guidance in the investigations of many neurogenic diseases, in a variety of diseases of the central nervous system with motor dysfunction and in some myopathic disorders.

Following are the some most important procedures which are utilized to determine various aspects of neuromuscular function—

1. Muscle stimulation.

A. Quantitative and qualitative aspects of response

(i) Faradic stimulation
(ii) Galvanic Stimulation.
To determine the reaction of degeneration (R.D.).

B. Special Tests
(a) Strength duration curves (SD-C)
(b) Progressive current ratio
(c) Galvanic tetanus ratio
(d) Neurotization Time (N.T.).

2. Percutaneous stimulation of peripheral nerves.
3. Electromyograph.

Muscle Stimulation—Electrodiagnosis is nothing but the interpretation of electrical stimulation of the nerves and muscles. The response of the skeletal muscle to electric stimulation may be studied by application of a current over the motor point—the point of entrance of the nerve into the muscle belly. Where the peripheral nerve supply to a healthy muscle is intact. The application of a brief electric stimulus to the nerve or muscle, directly or through the skin, will result in a brisk contraction, followed by a rapid relaxation. When the nerve is damaged or destroyed, there will be found change both in effectiveness of the stimulus and the response of the stimulated tissues. These changes are called the 'Reaction of Degeneration' (R.D.). In certain other cases with involvements of the neuromuscular unit such as occurs in the persence of myasthenia or myotonia, the introduction of an electrical stimulation can elicit characteristic abnormal reactions of nerves and muscles. The electrical stimulation may be qualitative or quantitative but for ordinary determinations the qualitative examination is prefered by authorities because it is simple and quick. Such testing ordinarily employs two different currents, the continuous (direct galvanic) and the alternating, (tetanizing, faradic or sinusoidal).

Most modern equipments—Neurotone stimulator and Ten pulse stimulator are used for the purpose of determination of reaction of degeneration. This can be done by objective and subjective procedures. For subjective purposes test is carried on by stimulating by faradic and galvanic stimulation and by noting down their responses while for objective purposes special method like S-D curve will prove to be of utmost utility.

The presence of R.D. (Reaction of Degeneration) indicates that the particular muscle is no longer innervated. The lesion may be near the end plates, in the anterior horn cells, or anywhere in between, in simple words it can be said that the lower motor neurone lesion is present there. If the lower motor neuron is intact regardless of the status of the upper motor neurons which ordinarily transmits to it, there will be no R.D. The absence of R.D. means that the peripheral motor nerve is functionally intact.

(To be continued)

PHYSIOTHERAPY AS AN AID IN DIAGNOSIS, PROGNOSIS AND TREATMENT

DR. J. C. PAHWA, New Delhi

(Continued from page 443)

Response to the Faradic current stimulation:

As is well known, the faradic current provides stimulation with a duration of approximately 1 millisecond and a frequency of 50 to 100 per second, which when applied to a normal innervated muscle causes a tetanic contraction. As the stimuli are conducted via the motor nerve only so they are too brief to affect denervated muscle.

Reduction in the strength of the response to the faradic current (assessed by comparison with the same muscle on the unaffected side of the body) indicates either that some of the nerve-fibres supplying the muscle have degenerated so that such muscle fibres do not receive a stimulus, or that the muscle is weak. Absence of response to the faradic current may be due either to degeneration of all the nerve fibres supplying the muscle or to degeneration of the muscle tissue, so that it is incapable of contracting.

Response to the Galvanic current stimulation: The interrupted direct current provides in frequently repeated stimulation, with a duration of approximately 100 milliseconds. Normally innervated muscle responds with a brisk twitch followed by immediate relaxation to each stimulus. Denervated muscles also give response but the resulting contraction will be sluggish in nature. If a muscle is partially denervated, the innervated fibres contract briskly, the denervated, sluggishly. This results in a slightly sluggish contraction, here it may be possible to distinguish a brisk contraction followed by a sluggish relaxation.

Thus if contraction of normal strength is produced on application of faradic current, and a brisk twitch with interrupted direct current, it can be assumed that the motor nerve is intact and the muscle fibres is of normal strength. If the response to the faradism is reduced in strength, the interrupted direct current may produce a brisk twitch, indicating weakness of the muscle but no denervation, or it may produce a slightly sluggish contraction, indicating the partial denervation. If there is no response to faradism, there may be no response to interrupted galvanic current as well indicating degeneration of the muscle fibres or there may be a sluggish response to the interrupted galvanic current, indicating complete denervation.

Strength Duration Curve (SD-C):—Among the variety of methods, SD-Curve has an undisputed place in the electrodiagnosis. In quantitative assessment of neuromuscular excitability the strength of the stimulus required to produce excitation and the duration of the applied stimulus are

the important factors to be kept in mind. The rheobase or the threshold response, is the minimal intesity of current of prolonged duration necessary to excite the tissue, while the chronaxie is the minimum time required to excite the tissue for a stimulus of twice the strength of the rheobase. The rheobase is measured in volts or milliamperes and chronaxie in milliseconds. The relationship between strength of applied stimulus and the duration of its application for minimal excitation is expressed by the strength duration curve. Chronaxie determinations are dependent upon a formula relating muscle response stimulus duration and stimulus intensity, C= (c) local excitability state (Intensity duration). Strength duration curves also determine this same formula, instead of a single chronaxie reading multiple intensity and duration values in relationship to C are established and plotted. Such curves when plotted repeatedly give prognostic information too. In Ten pulse stimulator, which is usually used for the purpose, stimuli with durations of 0.01, 0.03, 0.1, 0.3, 1, 3, 10, 30, 100 and 300 milliseconds can be availed. A normal S-D curve will be flat, showing a rise only at the zero end of the time abscissa. Denervation is characterized by a sharply progressive shift of the curve to the right—a fall in rheobase and a rise in chronaxie. On the other side reinnervation is characterized by a shift of the curves to the left with a fall in chronaxie and a rise in rheobase. In case of partially denervated muscles—where only a part of muscle or scattered fibres are denervated and/or innervated shifting of the kink in the curve, plotted time to time, gives a prognostic information as well. Determination of chronaxie and rheobase carries its own importance in helping in diagnosis and prognosis of peripheral nerve injuries, cord lesions-anterior poliomyelitis, peripheral neuropathies, myopathies myotonia —and in miscellaneous conditions such as rheumatiod arthritis. Chronaxie proves to be a quantitative Reaction of Degeneration test, as, when the nerve to a muscle is intact, the chronaxie will be less than a milliseconds and when, there is complete degeneration of a peripheral motor nerve, the muscle it supplies will have a chronaxie of more than a millisecond. Its specific speciality is that it offers a specific numerical index to the R.D.

S-D curves too have got some limitations. First of all this technique gives a picture of the superficial muscles only. Secondly this test does not reveal the site of the lesion. Electromyography is the only method which indicates the site of the lesion. But despite these limitations S-D curve deserves an important place in the routine examination and assessment of progress of lower motor neuron lesions.

(ii) Galvanic Tetanus Ratio (G.T.R.)—The term galvanic tetanus ratio has been applied to the relationship between the intensity of current required to sustain a galvanic tetanus, and the galvanic threshold. In normal individual this ratio is approximately 3.5 to 6.5, while in case of denervation this remains about 1.0 to 1.5 and in case of regeneration it may go from to 1.0 to 20.0 then back to normal value.

(iii) Progressive Current Ratio:—This test relates the threshold of contractile response to stimulation with progressive current to the rheobase and is of considerable value in the detection of partial denervation, as it is based upon the loss of accommodation of denervated muscle.

(iv) Neurotization Time (N.T.):—Neurotization i.e. nerve growth, proceeds more rapidly than the return of function (maturation). In the early stage in regeneration a nerve adds about 3 mm a day and towards the end of regeneration, it grows about 0.5 mm a day with an overall average growth of 1 mm a day. This is to be noted that during the period of regeneration, the Reaction of Degeneration is present until the terminal axons reestablish continuity with the end plates. It is possible for motor units to regain function long before neighbouring units, as some axons grow faster than others. In such cases there may be seen partial return of voluntary function and partial response to tetanizing current (P.R.D.).

In some cases patients regain voluntary function before the electrical reaction changes. This may be explained as a phase in the maturation process during which myelinization lags.

This, neurotization time, can prove to be a useful index which will represents a ratio of the duration of the neuropathy to the theoretic time necessary for reinnervation to take place. This formula is as follows:—

$$\% \text{ Neurotization Time} = \frac{\text{Elapsed time since degeneration} \times 10}{\text{Theoretic time for reinnervation.}}$$

In this, theoretic time is based on the estimated rate of growth (which as has been discussed above, is 1 to 5 mm per day). One hundred percent neurotization time thus indicates that just minimal time has been elapsed for reinnervation. If the neurotization time exceeds 250% with no electrodiagnostic evidence of regeneration, the prognosis is poor and so surgical intervention will have to be called upon.

Percutaneous Stimulation of Peripheral nerves:—Peripheral nerves at certain points are superficial where response can be seen even with low threshold of excitation, with stimuli of extremely short duration. Contraction of each individual muscle innervated by that particular nerve, will be seen by the percutaneous stimulation of the nerve. Partial denervation can also be identified quickly in this manner. Sensory loss may be estimated by stimulation with a voltage level just below that required for motor response.

Electromyography :—

Electromyography, in simple words, may be defined as the recording and study of the intrinsic electrical properties of skeletal muscles, in other words, it can be said that it is concerned with the detection, recording and interpretation of the electrical voltage generated by skeletal muscle. Many years have been spent for progress in instrumentation and laboratory trials to obtain its status.

In fact a muscle contraction is associated with an electrical disturbance. A series of electrical potentials, called action potentials, are set up, the current produced by these action potentials can be collected by electrodes on the skin or by a bipolar needle electrode which is inserted into a special part of the muscle. It is then amplified and led to a loud speaker and to a cathode tube, where a graph can be seen on the screen. One may thus simultaneously listen to and visulize the muscle potentials and electrogram can be preserved for the record.

Let us now discuss the different characteristic electromyographic patterns.

A normal voluntary muscle at complete rest is electrically silent, but active movement or reflex contractions produce action potentials. The motor unit consists of one lower motor neuron and the muscles fibres it supplies. The axon branches and terminates in several motor end-plates, each of which supplies a muscle fibre. Each motor unit produces its own action potentials which are diaphasic. But those from the different motor units are not synchronous. Instead they appear one after the other in an irregular manner, the wave of current from one motor unit breaking into the wave of other. This produces an interference pattern on the screen and a loud rumble on the loud-speaker or with maximum activity a loud roar. It has been said that approximately 5% of the motor units normally seen may show multiple spikes i.e. complex or polyphasic waves. The duration of the spike varies from 5 to 10 milliseconds, and the repetitive frequency is 5 to 30 per second or even higher depending on the intensity of the contraction. The magnitude of the motor unit averages from 100 to 2000 microvolts, even much higher amplitudes have been reported.

Lower Motor Neuron Diseases:

Peripheral nerve injury—Degeneration of the nerve is associated with fibrillation of the muscles it supplies and loss of active movements. Fibrillations is the involuntary twitching of the muscle fibres which occurs when the muscles begin to degenerate. The potentials shown on the screen from this form of activity of the muscles will be lower than those from normal activity and of very short duration appearing as spikes and producing sharp clicks in the loud speaker. A partial nerve lesion will show some normal potentials on the screen when the muscle is at rest. The magnitude of these waves is from 5 to 100 microvolts, the duration from 1 to 2 milliseconds and repetitive frequency from 5 to 30 per second. The form will be diaphasic with an initial negative deflection followed by a positive deflection of equal height.

Regeneration of the nerve fibres may be detected when growing fibres reach the muscle end-plates and before active movement or the faradic reaction returns. The fibrillation potentials become less in number and a few small and short duration action potentials appear on attempting active contractions of the muscles.

Peripheral neuropathies:—The electromyographic records will exhibit different changes from the peripheral nerve injuries. There is often complete silence, both at rest and on attempting voluntary contraction. Fibrillation is less frequently encountered. Large rhythmic action potentials with voltages from 6 to 8 times greater than normal ones.

Nerve Root Pressure Syndrom:—Any condition which is capable of producing pressure upon a nerve root may result in a nerve root pressure syndrom. Tumor, vascular anomalies, cysts, spinal fractures, perispinal abscess and osteoarthritic spurs are some of the causes of this syndrom. However, most common cause of nerve root pressure is herniation of a spinal intervertebral disc. Though it is fact that electromyography cannot differentiate one aetiological factor from another but certainly we can note that irritative lesions of the nerve roots of the spinal nerves may result in a spontaneous discharge of simple or complex voltages and produce an involuntary contractions either of a single muscle fibre or the entire motor unit. Simple fasciculation voltages are of normal motor unit size or configuration and may be continuously present during rest and activity. Complex fasciculations are similar to polyphasic potentials.

This is to keep in mind that in axonal compression bursts of grouped motor unit potentials are evoked, which is a differential source in distinguishing between neuronal and axonal irritative lesions.

Poliomyelitis:—The optimal time for electromyographic examinations is at about the sixth week after onset. From the sixth week to about twelveth week, such studies do have the prognostic value as well, though over and above what may be gleaned from a good clinical evaluation. In poliomyelitis patient we will find several combinations of findings. First, there is the muscle which after thorough examination reveals essentially electrical silence both during effort and during relaxation. Complete electrical silence may also be seen quite late in the disease. The second type of electromyographic finding in a poliomyelitic muscle is that denervation fibrillation throughout the entire substance of the muscle. A third type of finding, in this type of electromyography reveals denervation fibrillation with the muscle relaxed as well as discrete motor units potentials during efforts to contract. Fibrillation potentials may be distributed diffusedly throughout the entire muscle or may be found in greater abundance in specific areas.

Spontaneous and irregular fasciculation potentials are characteristic of spinal lesions. In poliomyelitis these are sometimes noticed and are frequently polyphasic. Such 'complex' units may have duration varying from 3 to 5 milliseconds and their amplitude may vary from 100 to 1200 microvolts.

Upper motor neuron diseases and Central nervous system lesions:—

Electromyographic studies are of paramount importance to play the role as an aid in diagnosis in cases of upper motor neuron and central

(Continued on page 528)

PHYSIOTHERAPY AS AN AID IN DIAGNOSIS, PROGNOSIS AND TREATMENT

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(Continued from page 528)

The Role of Physiotherapy in Treatment

As quoted before the ultimate aim of physiotherapy is the restoration of the fullest functional activity possible.

Keeping in view the consideration of the requirements for health and functions, certain principles are of vital importance in the rehabilitation of a patient.

Guiding principles of Physiotherapy:—In the interests of healing, in order to alleviate symptoms, or in the interests of general tissue health, or to minimize the risk of adhesions by the absorption of excessive inflammatory exudate, or to reduce the risk of trophic changes or disuse atrophy and finally to prepare muscles for work and to maintain unaffected tissues in a healthy functional state, circulation and tissue fluid interchange should be maintained and/or increased. Further for the ease of the movement joints must be as mobile as possible and unless the muscles have got sufficient strength the joint can't be moved through its full range by the patient. To combact this muscle power must be maintained and increased. For this purpose sometimes we may need mechanical aids or appliances too in addition to the remedial modalities. To keep up the general health of the patient especially the one who is bed-ridden, this is to be kept in mind that the respiration of the patient should be adequate. As far as possible, the patient should be relieved from his specific symptoms, such as, pain oedema, and spasticity etc. And complications like trophic changes, the formation of adhesions, contractures, sepsis, thrombosis and chest conditions should also be prevented in time by suitable measures*. A physiotherapist should also be well versed to prescribe, then to instruct the patient for the use and maintenance of aids and appliances. In the last, it is also the prime duty of the therapist to keep up the morale of the patient and to imbibe self confidence in him, to prepare him to face the present circumstances, handicaps, if any, as this also comes within the province of the physiotherapy.

After the discussion of the principles now comes the term of different methods and modalities—the indications and contra-indications—of physiotherapy, to discuss.

Thermal therapy, exercise therapy, electrotherapy, hydrotherapy and

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* Experience has established the fact that Homœotherapy is the most dependable measure in these conditions.—Ed.

massage etc. are the main vehicles of the physiotherapy in the field of treatment.

Thermal Therapy:—It is treatment through heat. Heat is of the most commonly employed therapeutic measures. And the application of heat in the treatment of the disease is amongst the oldest forms of therapy known to man. Locally heat is used in the form of poultices, hot packs, hot water bottles, electric pads, special electric lamps—arranged singly or in multiple, short wave diathermy etc., while general heat is used in the form of hot water baths, steam baths, vapour baths, dry thermal cabinets and electric blankets.

Regardless of the method of application the physiologic effects are basically the same. Heat applied externally, brings about an increase in circulation. The increase of tissue temperature increases the local metabolic activity which further adds to the elevation in temperature and produces the local metabolic activity which again helps in vasodilatation. Increase in circulation permits the waste products of inflammation to be carried off into the system. Well known effects and objects of the heat are sedation, relief of pain, swelling and spasm.

The use of heat is indicated in contusions, strains, sprains, dislocations, fractures, synovitis (except tuberculosis), bursitis, tenosynovitis, backache, joint stiffness, arthritis, infantile paralysis and in many other conditions. Heat should be carefully used in acute inflammation or acute trauma until the initial reaction has subsided. Obstructed venous, arterial circulation and known or suspected areas of malignancy present a definite contra-indication in the thermal therapy.

The application of heat, in regard to its effects, can be classified into two forms—superficial and deep heating.

In acute stages where only superficial heating is indicated and prescribed, which causes rise in temperature not beyond 1 to 2 centimeters. Following thermal therapeutic means are generally used.

Infra red radiation—which can be obtained by luminous bulbs or non-luminous elements. When the Radiator is placed at a distance of about 14″ to 18″, the penetration of heat of infra red rays is about 3 millimetres and that of far, about 24″ to 30″ is about 1 millimetre.

Hydrotherapy—It is the application of water for the treatment, being used for therapeutic purposes since ancient times. In fact water is versatile medium for thermal application. The hydrotherapeutic means of applying heat that are most often used are whirl pool bath—an efficient means of conducting heat to the extremities, Hubbard tank—preferable when whole body is to be heated; hot packs—provide very superficial heating; contrast bath—forearm or lower legs are immersed alternatively in hot and cold water, which produces an active contraction and relaxation of blood vessels leading to the increase in blood flow. Temperature of cold water is kept upto

60°F while hot water at 105°F. The part is immersed in the hot or cold water in the following order—

Hot water 5 minutes then cold for 1 minute.
Hot water 3 minutes then cold for 1 minute.
Hot water 3 minutes then cold for 1 minute.
Hot water 3 minutes then cold for 1 minute.
Finish with 5 minutes in the hot water.

Wax Therapy—Application of wax is used for superficial heating. This paraffin wax consists of three parts wax, 1 part paraffin, 1 part light mineral oil or glycerine, which is used to bring the melting point to about 106°F. Regarding its application either part, especially hand or foot, is slowly dipped in the melted paraffin wax and then removed, this process is repeated again and again till a coat is formed, which is wrapped in the towel for about 20 minutes, or the other method is that wax is poured on the part and then wrapped in towels. This is a very simple and cheap method and leaves the skin soft and pliable.

Deep Heating—For deep heating certain form of such a physical energy is required that can penetrate the skin and heat the deeper tissues because direct superficial heating devices prove to be inadequate for the production of heat in deeper tissues. Short wave diathermy, micro wave diathermy and ultra sounds are used for this purpose.

Short wave diathermy—Maximal depth of temperature rise is about 2 to 3 centimetres over a period of about 20 to 30 minutes. Its wave length is limited from 3 to 30 metres with a frequency from 10 to 100 megacycles. Intensity is regulated by the comfortable tolerance.

Micro wave diathermy—Radiated electro magnetic waves, at a frequency of 2450 megacycles per second with a wave length of 12.2 cms is used in the therapy. Adequate deep heating effects can be obtained at a depth of 5 centimetres. Treatment is given from 10 to 20 minutes.

Ultra Sounds—Mechanical vibrations ranging from 0.7 to 1.0 megacycle consist the ultra sound therapy. Some heavy oil is used between the applicator head and skin. If water is used as media, applicator is kept at about ½" from the skin. Suggested doze is from ½ to 6 watts per square centimetre for about 3 to 5 minutes.

Short wave diathermy is given for larger areas while microwave and ultra sounds for the small extent of surface areas. If some unpleasant sensations are noticed, treatment should be discontinued or intensity should be decreased. This is to keep in mind that ultra sounds are contraindicated in or about the brain, eyes, ears, nasal sinuses, heart, reproductive organs and epiphysis of growing bones and over larger nerves it should be used with great care. Other contra-indications for deep heating are the tendency to hemorrhage, over a pregnant uterus, or when some metal is present in the part.

Exercise Therapy—Therapeutic exercise itself is a science. The development of the therapeutic exercisess as a modern science dates to the publication in 1866 in France, of the new classic work of Guillaume Benjamin Duchenne —'Physiology of Motion'. He states in that "a knowledge of the muscular mechanism leads to a rational treatment of paralysis, atrophies and deformities by application of special local stimulation, physical exercises and physiologic prosthesis."

It will not be out of place to say that MOVEMENT IS LIFE. The movement of muscle and joint has a mechanical pumping effect which assists the venous and lymphatic return. It also assists to keep the cortical pathways open, so that pattern of movement is not forgotten. Main objective of the exercise is to increase the muscle power, endurance, coordination, range of motion, besides to increase speed, which is considered as the last phase of rehabilitation program for most of neuromuscular conditions. Not only that, these (movements) will help to prevent the deformities and other complications and will improve the balance. And further the exercise vitalises the dormant neurons and is of great value in exciting the cells of the motor areas. The use of mass movement pattern (Kabat's technique) and reversal of antagonists and possibly of primitive reflex movements (Sherrington's technique) will all increase the bombardment on the cells of the anterior horns of the spinal cord and thus activate the muscles. Pool therapy and suspension therapy, in which exercises are given in pool or in suspension respectively are useful to the patients for increasing muscle power and range of motion as well.

Electrotherapy—It is the treatment through electric currents. The electric currents have a definite place among the physical agents available for therapeutic purposes. Its use is based on physical laws and physiologic response. The variation in the physiologic response of body tissue to currents of different frequency and voltages provides a basis for simple division into currents with heating effects and currents with stimulating effects. The flow of an electric current can be either unidirectional i.e. direct or alternating. Both direct and alternating currents have a very definite field of usefulness in the treatment of properly selected pathologic conditions. For heating effects alternating current of very high frequency and relatively high voltage is utilised, as in diathermy, while for stimulating the nerve or the muscle 'low voltage currents' are required. The low voltage currents include the direct and the low frequency current like faradic or sinusoidal currents.

Direct current—The direct current when passed through an electrolyte, presents positive and negative polarity effects. The reactions found at the positive pole are opposed diametrically to those found at the negative pole. The physiological or biological effects of a current are the effects on living tissues such as skin, nerves, muscles and blood vessels.

When direct current is used in treatment, throughout along with the pathway of current vasodilatation in the tissues occurs. As a result of the

vasodilatation there is increased blood supply to the tissues, an increase in supply of nutritive materials is made available and removal of waste products is accelerated.

As stated above the different effects are produced immediately under the anode i.e. positive, and cathode-negative, electrode. In order to obtain the anodal effects the anode is applied over the area to be treated and the circuit is completed with a larger cathode elsewhere on the body. Due to its physiologic effects the conductivity and excitability of the nerves under the anode are reduced, this effect is utilised to relieve the pain and muscle spasm in the treatment of recent injuries, such as sprained ankle, and in the more acute stages of inflammation, as in rheumatoid arthritis and tenosynovitis and as palliative measure in cases of sciatic pain due to prolapsed disc. Its anaphoretic effect is used to assist in the reduction of recently accumulated fluid, due to recent injuries and inflammation in cases of sprained ankle, synovitis of knee, Bell's palsy upto 7 to 10 days following exudation. To achieve good results $\frac{1}{4}$ to $\frac{1}{2}$ a milliampere per square inch, intensity is used.

Excitability and conductivity of the nerves is increased under cathode, so sensory nerve endings are stimulated thus bringing about increase in circulation, and relief of pain by counter-irritation. Because of its property of increasing circulation this is utilised in cases of chronic inflammation—osteoarthitis, stiff joints following injury and chilblains and lower motor neuron lesions. Cataphoretic effect of this current is claimed of great value in softening scar tissues. To achieve these properties the cathode is applied over the part to be treated and the circuit is completed by a larger anode elsewhere on the body, density of current used is .2 milliampere per square inch.

Iontophoresis or Ion Transfer—When direct current is passed through an electrolyte a migration of ions occurs towards the two poles of the circuit. The greatest field of usefulness of this is the introduction of the ions or the exchange of ions within the tissues for definite therapeutic effects by means of direct current. This procedure is known as ion transfer or 'Iontophoresis'. The positive pole is used to introduce the positive ions and negative pole for negative ions. The active electrode is saturated with the required electrolyte solution. The ions lose their electric charge and precipitate in the superficial tissues as soluble or insoluble compounds.

A large number of clinical reports have been written on the use of ion transfer for various diseases.

Most frequently Histamine and Mecholyl chloride are used for their vasodilatation effects in cases of arthritis, some chronic ulcers and certain vasospastic conditions of the extremities.

In the following few lines I would like to give at a glance a study of different drugs with their indications:—

Mecholyl ions for acute pelvic inflammation of tubal origin (Craig &

Kraff) and in sciatic neuritis (Johnson & Dolan), varicose veins (Saylar); and Raynaud's disease. Fleming reports that principal feature of treatment by ions transfer is the reduction of congestion. It is also used for scleritis, iridocyclitis, retrobulbar neuritis and in many ophthalmic conditions.

Acetylcholine, quinine, eserine, pilocarpine, iodides, salicylates prove to be efficient to promote vasodilatation.

In otorhinolaryngological cases, for preventing nasal polypoid tissue, in cases of polyps, hay fever and allergic conditions, hyperesthetic, infected wounds, ulcers, sinuses and mucus membrane and in the treatment of rhinitis and chronic otorrhea Zinc ions play an important role.

Copper ions—in cases of fungus infections, epidermophytosis.

Acetyl—beta methycholine chloride in cases of pelvic conditions with exudative inflammatory processes; thrombophlebitis, diabetes; vasospastic arterial diseases and in phlebitis etc.

Chlorine ions—to cause softening of the scar tissues.

Salicylate ions—Rheumatic conditions for relief of pain.

Albucid—(Sulpha acelamide ions)—infections of eyes for destroying certain bacteria.

Renotin and Carbachol ions—to promote vasodilatation.

There are a number of other drugs which can be used in this method for the treatment purposes.

Electrolysis:—When a small electrode is used with the concentration of current, destructive effects may be produced. This effect can be used for removal of unwanted hairs.

In addition to these uses of the direct current, it is also used in the forms of galvano therapy, hydrogalvanic baths, schene baths as well.

Low Frequency Currents:—These include faradic and sinusoidal currents which have got quite low and constantly changing voltage with varying frequency, 50 to 100 cycles per second. Treatment with these currents is carried on for re-education of muscle action, training of a new-transplanted-muscle action, exercises for paralysed muscles when no degeneration of motor nerve is present, and also to increase the circulation, to improve the lymphatic drainage in cases where oedema or gravitational ulcers are present; to prevent and loosen adhesions and also for counter irritation.

Massage—Massage is also one of the oldest remedial modalities used by man. The Chinese describe massage in records of 3000 years ago. Massage exerts physiological influences which can be utilised in the treatment of a wide variety of clinical conditions. Although its various techniques—stroking, pettrissage, kneading frictions, vibrations and percussions etc. etc.—produce slightly different effects but the overall effects are that massages produces local relaxtion by its sedative or stimulating effects of sensory nerve endings; produces a local hyperaemia, helps in venous and lymphatic returns, re-

moves subcutaneous tissues and has got stretching and softening effects of fibrous tissues.

Massage is indicated in the following clinical conditions as an adjunt to the treatment.

Soft tissue trauma—sprains, contusions, strains, and lacerations, contraction due to prolonged tension, backstrains or strenuous exercises, scars and adhesions, inactivity due to disease or peripheral nerve lesions, fibrositis, fractures, arthritis, circulatory disorders with resulting oedema, insomnia and hypertension etc. etc.

But acute inflammation, skin lesions, malignant swelling, acute circulatory disturbances such as phlebitis, thrombosis or lymphangitis are the main contraindications where massage may prove to be harmful in place of any benefit.

Ultra Violet Rays—Nature offers the Sun as a source of valuable ultra violet rays, to the mankind. And by artificial means we can have it from carbon arc lamp, mercury vapour lamp, or electric arc tube mercury lamp, or kromayer lamp for the therapeutic purposes. These rays produce erythema, pigmentation and cause the formation of Vitamin D, and stimulate the growth of epidermal cells. These properties have got their specific role in the treatment for formation of Vitamin-D, especially in cases of rickets and other cases caused by the deficiency of Vitamin-D, for increasing resistance of skin to infection, to improve the circulation of skin for destruction of bacteria, destruction of tissues and for counter-irritation.

Acute tuberculosis of lungs, acute eczema, acute dermatitis and acute psoriasis are the main contraindications.

Cold Therapy—In addition to the role played as thermal agent hydrotherapy has got its therapeutic use as cold therapy as well. Local application of cold causes vasoconstriction, decrease in blood flow, decrease in local metabolic activity and decrease in local temperature. The extent of effects depends upon the nature of temperature of the substance applied and the duration of the treatment given. Ice bags, cold water baths and compressions are used to minimize the initial reaction of the tissues to local traumatic injuries, such as contusions, sprains, etc. Cold compressions and packs also help to reduce the fever, neutral baths have sedative effect on nerves, abdominal wet bandages relieve the constipation.

Thus we see, from the above discussion, that physiotherapy can play an important role as an adjunct to the treatment. (Concluded)

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SIMILITUDE AND EPILEPSY

(Continued from page 549)

nothing at that moment; only protect him from biting his tongue. One must avoid excessive protectiveness which becomes an obsession and makes the epileptic into an invalid.

One must treat him as far as possible like a normal child, watch over him in sports or in dangerous places without his realizing that he is being watched. One must give him the feeling of responsibility like other children. Terror at the crises is the cause of an atmosphere charged with anxiety and the over-protectiveness so prejudicial to the small epileptic. One must not forget the psychogenic causes which arise from many crises. One must always make a constructive psychotherapy dependent upon the atmosphere in which the child evolves and develops.

Somatic hygiene implies the correction of dietary errors, norms of life, study (not to overload him as is done at present) school, English, dancing, music, without sufficient time for the minimum physical requirements of exercise, sleep, sociability and recreation. Only in this way shall we have favored cure and not failure when the homœopathic remedy is the proper *similimum*.

—The Layman Speaks, Oct., '60
