ELECTRO-THERAPY OF PARALYSES

(BASIC PRINCIPLES AND METHODS OF APPLICATION)

(Continued from "Physiotherapy", January, 1957.)

By Dr. Harold Thom

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6. General Directions for Treatment

Before commencing the therapy, a detailed clinical and electrical survey should be made and the data recorded on a suitable printed form. This is the only means of obtaining a reliable picture of the progress made during the treatment. Since the therapeutist is now able to investigate the individual characteristics of each muscle or each set of muscles by varying the stimulus parameters, it has proved useful—necessary in fact—to keep an accurate record of the optimum adjustments of the parameters which suit each individual characteristic, whether obtained empirically or ascertained from I/t charts. If these are conscientiously recorded, conscluions may be drawn as to the progress of treatment. Use should only be made however, of those impulse values which, while inconveniencing the patient as little as possible, are most successful in creating a response. At the same time the impulse value should remain within the limits of an adjustment which is as close as possible to normal stimulus conditions. Thus the gradient of the individual impulses should be as steep as possible and the impulse duration as short as possible, but as long as may be necessary to effect the stimulation required. The aim of all electro-therapy must be to obtain the strongest possible contraction of the muscle structure requiring treatment. It is often found that the staff carrying out a certain treatment are content with the contraction of any one muscle, instead of being concerned with stimulating the damaged muscle or muscle group selectively, always assuming that this is possible in the particular case being treated.

For successful treatment, the important thing is not only to discard all preconceived ideas but in each case to try to achieve the best possible result from a functionally useful and powerful muscle contraction by selecting the most suitable impulse values. For this reason, firm rules for treatment cannot be given, only general directions which must be modified from case to case.[1])

It is inadvisable, especially in the case of poliomyelitis, to start excitation current therapy, i.e. to use impulse currents, until all inflammatory and spastic phenomena have disappeared. Up to this point only constant DC therapy should be used, the efficacy of which has already been discussed above.

Adequate anatomical knowledge is an essential prerequisite for all effective electrotherapy of paralyses. The correct application of electrodes demands accurate knowledge not only of the position of muscles and nerves, but also of their function.

In principle, there are two methods of electrode technique, viz. unipolar and bipolar. In the former, two electrodes of unequal size are used, the smaller being referred to as the active or effective electrode, and the larger as the inactive, indifferent or dispersive electrode.

In unipolar electrode technique the muscles or nerves are stimulated from certain definite motor points on the surface of the skin. These are in the main empirically determined areas, whence the nerve situated below can be stimulated with an optimum current density. The motor point is generally located where the main branch of the nerve enters the muscle it serves.

Under the conditions prevailing in former times, this method of muscle stimulation was the best available, yet it possessed grave disadvantages, especially in the therapy of badly paralysed muscle structures. With the more powerful currents required with this method, stimulation is very painful, as the whole of the current is concentrated at a single point (see Fig. 4). Moreover, in view of the extensive damage to the particular nerve stimulated, there appears, from the outset, to be little point in using it for transmitting a stimulus. In monopolar electrode treatment, since the motor point is normally located near the centre of the muscle, only one half of the muscle will be permeated by the current. The so-called "Distal shift of the motor point" constantly observed by the old therapeutists (the indifferent electrode being usually applied proximally) is thus readily explained, because movement of the stimulation point causes an increasingly large part, and eventually the entire muscle, to be permeated by the current.

In the past, since adaptation to the different conditions of sound and de-enervated muscle structure by varying the form of current was impossible, the only alternative was to attempt to stimulate diseased muscle from the topographical viewpoint. Since, however, paralysed muscle requires much greater current strengths than adjoining sound muscles, in the end it was usually a case of so-called "puncture," i.e., only the sound antagonists were stimulated, the muscles really requiring treatment being at best only stretched in an unsuitable manner.

Since to-day, variation of current form permits close adaptation to the physiological or pathological conditions of the various nerve muscle systems (at any rate for therapeutic purposes), a bipolar electrode technique is preferable. This involves placing two large, well padded electrodes over the origin and insertion of the muscle concerned (see Fig. 5). This ensures from the outset that the whole

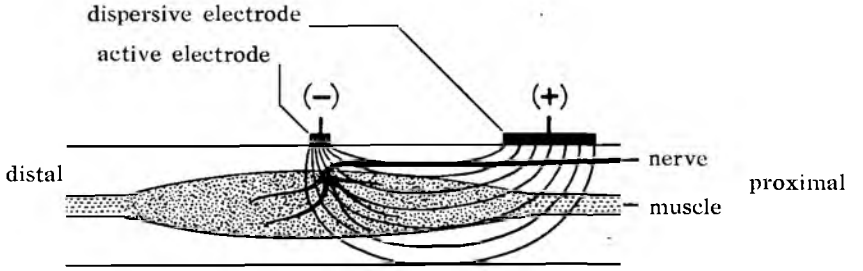

Fig. 4. Flow of the current, with unipolar stimulation, starting from the motor point. Only one half of the muscle is permeated.

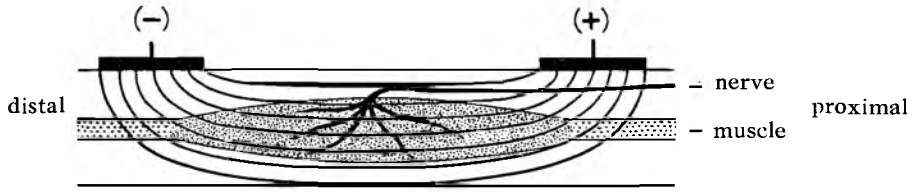

Fig. 5. Flow of the current, with bipolar stimulation. The whole muscle is evenly permeated.

muscle is permeated at a maximum current strength. This means that higher current strengths can be applied and stronger muscle contractions obtained without causing pain to the patient.

Reference has already been made to the advantages of preliminary treatment with galvanic current. The resultant hyperaemia and the reduced stimulus threshold (rheobase) for the subsequent active or passive electro-gymnastic treatment may, however, also be achieved by other methods which promote circulation, e.g. hot baths, vapour baths, electro-thermal baths, etc. LAMPERT has also observed favourable results after using hyper-thermic baths (in small doses).

The diagnostic curves (I/t curves) give a reliable indication regarding the selection of the form of current to be used for therapy. As the effective time is increased, longer impulse durations will be required, and as the excitation threshold is increased, a greater current strength is needed. Generally speaking, it is a useful principle to try to manage with a *minimum of current intensity* and to extend the period according to the conditions revealed by the I/t curves. In order to reduce the pain factor and to obtain the desired selectivity of stimulus, a gently rising (not vertical) current impulse should be used almost invariably. Since the refractory or recovery period of the muscle is always prolonged in relation to the increase in effective time, this point must also be taken into account in selecting the rest period. As a general rule, the rest period should be three to five times the impulse duration.

For treating badly paralysed or badly atrophied muscle structure, gradually rising current impulses of altogether 150—600 ms duration and intervals of 3—5 seconds should be used (see Fig. 6). The intensity is stepped up gradually until a strong contraction occurs.

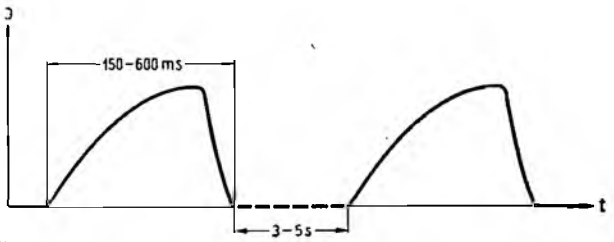

Fig. 6. Impulse sequence with long triangular impulses and extend edintervals, for treatment of paralytic disorders of a medium to severe degree.

Intensity, gradient and impulse duration must now be varied in relation to each other until an optimum relationship has been established between a maximum contraction (confined mainly to the diseased muscle group), and minimum sensory strain. This is the only way in which a suitable selective exercise therapy can be achieved which is also adapted functionally to the existing conditions.

In the initial treatment of a seriously degenerated muscle at constant current strength, there is often evidence of rapid fatigue which manifests itself in a noticeable decrease in the degree of contraction. In such cases it is advisable either to prolong the rest period still further, or to suspend the treatment on this occasion. The current intensity should not be increased since improved therapeutic results cannot be forced. In fact, if treatment is greatly overdone, the muscle may even suffer damage. As time goes on (in many cases after only a few treatments), the increased improvement is shown by the fact that contractive capacity of the muscle either remains constant, or is less easily exhausted.

Circumstances permitting, in the first instance it is advisable to carry out the treatment at least once or twice, a day. Provided no premature fatigue phenomena appear, the treatment can soon be extended to last for a period of 10 minutes. Longer periods are unnecessary, since the aim must always be to apply the treatment for short but frequent periods.

For muscle structure which is only partly paralysed and where atrophy is low, short impulses of 50—150 ms. are sufficient, with usually 1—2 seconds for the rest period. Should this faster rhythm overtax the patient's strength, especially when at the same time he has to struggle to achieve additional active innervation, the rest period should be extended.

For normally innervated muscle, as encountered in cases of atrophy from disuse after fractures, enforced rest for longish periods, etc., the use of so-called tetanizing surge current impulses is the most promising method. This involves impulses of approximately 0.5—5 ms and an interval of approximately 10—20 ms. The resulting tetanal muscle contraction is best interrupted by regular intervals; in this process, the impulse sequences gradually rising to the selected maximum level and ebbing somewhat more rapidly, cause contractions which in their external course very closely approach the physiological movements (see Fig. 7). The surge rate and the form and intensity of the impulse sequences used must be adapted to the conditions prevailing at the time. Since muscle structure atrophied solely from disuse differs but slightly from normal muscle in its reaction to electric impulses, its selective stimulation is very difficult to achieve. With individually selected impulse durations, rest periods, current strength and gradient, as well as electrodes carefully selected as to size and positioning, there is scope for considerable success in this field. If necessary, the stimulus may be applied from the motor point, using an active electrode.

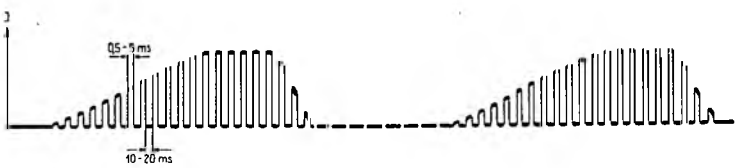

Fig. 7. Surging impulse sequence with short rectangular impulses and brief intervals, for treatment of normally innervated muscle structures in the case of atrophies of disuse and the like.

In all cases of atrophy due to disuse, as caused, for example, by a mechanical (plaster of paris, etc.) or functional immobilization (habitual paralyses, psychogenic paralyses, etc.) considerable improvements may frequently be achieved in a remarkably short space of time by electrotherapy.

General directions for treatment mentioned so far refer to flaccid paralyses as commonly encountered after nerve injuries, plexus lesions and poliomyelitis. As such muscles are inadequately supplied with nerve impulses, the problem is to preserve them from degeneration by applying artificial stimuli, related as closely as possible to natural processes, and by constant exercise, to ensure that the regenerating nerve finds a relatively sound muscle rather than one which has degenerated into connective tissue.

Quite different conditions are encountered in the case of spastic paralysis. Here it is not so much the motor paths which are disturbed as the inhibitory, accelerator and co-ordinating paths. Owing to its own increased reflexes, the spastically paralysed muscle is already in a state of constant convulsion (spasmophilia), and the preponderance of these muscles frequently leads to characteristic distortions of the limbs. Since any further stimulation would only increase the spasm of the muscle structure, any form of exercise under electro-stimulation is contraindicated. (Unfortunately such cases are still being irresponsibly treated with the so-called "faradic roll"). It should be the aim of any treatment to loosen the spasm as far as possible, and the simplest and most practical way of doing this is with stable galvanization. In many cases the results may be further improved by using a definite impulse current (impulse duration 20 ms, interval 20 ms, triangular rise). Very low currents, usually 0.5—2 mA are used.

In the case of slight spasms it would be a great advantage if means could be found to stimulate selectively such muscles as are unable to hold the balance against the gradually increasing contraction. In many such cases it is impossible even for an experienced and careful therapeutist to achieve appreciable selectivity even with the improved means of modern excitation current therapy.

Practical exercises under electro-stimulation also require that the position or the placing of the limbs to be treated be taken into consideration. To apply electrotherapy to an extensor, the joint in question must be in (gentle) flexion. Similarly, a flexor cannot be exercised if the extremity is already in extreme flexion.

Frequently, in spite of partial or even total anatomical restitution which may have been applied in the meanwhile, the patient has lost the capacity to innervate the remaining muscles or even intact muscle groups still left to him after disease or injury. In such cases electro-therapy can contribute decisively towards restoring the lost innervation paths, and for this the patient's co-operation is essential. For controlling the patient's real and active co-movement as well as for his own assistance, simultaneous movement of the relative contra-lateral muscle structure is a valuable help. Of more importance, however, are the "intention exercises" referred to by FÖRSTER, which, is often the olny alternative when mobility of the other side has also been lost. In FÖRSTER'S opinion, in fact, systematic voluntary attempts at innervation have a stimulating effect on the regenerative process itself. It is the purpose of the intention exercises to replace by an electric impulse, the vain attempt of the patient to carry out a particular movement; or alternatively, to assist an already existing but inadequate willed impulse by simultaneously releasing an electric impulse.

The simultaneous co-operation of these two impulses is best guaranteed by letting the patient release the electrical stimulus himself. Normally for this purpose, a supplementary device is used by means of which the patient can either release an individual impulse with a key, or can himself determine the intensity, duration, and rhythm of the surge current by using a rotary control. The form and maximum strength of the impulse sequence must be set in advance according to the degree of paralysis. For this the general directions stated above apply.

The value, and in fact the necessity for regular and properly timed stimulus intervals is frequently overlooked. It can often be observed that the rate of progress, after an extended period of electro-therapy, has increased enormously, especially after a fairly long break in the treatment. The frequency and duration of such intervals must be adapted to the individual circumstances of the patient. The most suitable distribution of stimulus and interval, or exercise and rest, will depend largely on the experience of the particular therapeutist. Normally, 2—3 weeks of continuous treatment should be alternated with 1 week's rest; and after treatment lasting several months a similar period of rest is to be recommended. Other reasons, however, may frequently compel the plan of treatment to be varied according to circumstances. Hospital treatment (possibly limited) will require a different arrangement from treatment carried out on out-patients.

It is surprising how exhausting an intensively conducted course of electro-therapy can be for the patient, since the former's physical and mental endurance may easily be strained to its limit by the misapplied zeal of his therapeutist. Since, however, the active and energetic co-operation of the patient is of paramount importance for successful treatment, care should be taken not to forfeit this co-operation by making excessive demands. In particular, in the case of patients suffering from insomnia, a well balanced therapy is reflected in a pleasant sensation of tiredness, and an increased desire for sleep.

In cases where the patient lacks the necessary will for recovery, the decisive factor inspiring and spurring the patient to co-operate in the restoration of his physical ability to work is the personality of the doctor, who should exercise kindness and care, and be of untiring endurance.

It has been necessary to devote so much space to the actual technique of treatment, as success or failure is vitally dependent on its proper execution.

Electro-therapy represents a small but important factor in the treatment of paralyses, a factor which in many cases cannot be replaced by any other method of treatment. The problem is to integrate it rationally into the overall plan of treatment, the ultimate object of which, is always the regaining of active freedom of movement.

SUMMARY: *The physical and physiological background of modern irritating electrotherapy is discussed in detail, as far as it concerns paralytic disorders, especially poliomyelitis. Review of the importance of intensity and time of current, increase, interval with reference to the different types of paralyses. Indication for therapy.*

*I am greatly indebted to Senior Physician DR. BECKER, of the Orthopaedic Clinic at Altdorf near Nürnberg, for his valuable assistance in connection with this work.

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CHRISTMAS CARDS
received by C.E.C., Christmas 1956.

MISS DYER—Northern Rhodesia.
MR. ROTHBERG—Johannesburg.
EAST LONDON BRANCH.
WESTERN PROVINCE BRANCH.
NORTHERN CAPE BRANCH.
UNITED CEREBRAL PALSY ASSOCIATION.
NATIONAL COUNCIL FOR CARE OF CRIPPLES.
CHARTERED SOCIETY OF PHYSIOTHERAPY, London.
AUSTRALIAN PHYSIOTHERAPY ASSOCIATION.
NOVSKE SYKEGYMNASTERS LANDSFORBOND.
BELGIUM.
DENMARK.
STOCKHOLM—SWEDEN.
FINLAND.
AMERICA.
W. GERMANY.

WORLD CONFEDERATION FOR PHYSICAL THERAPY

The following resolutions were passed at the Third General Meeting of the World Confederation for Physical Therapy held in New York in June, 1956.

PRESIDENT OF THE U.S.A.

Resolved: That the President of the World Confederation for Physical Therapy send to the President of the U.S.A. the Confederation's deep appreciation of his message and of the personal interest expressed therein and its most respectful greetings and prayers for his speedy and complete recovery.

WORLD HEALTH ORGANISATION.

Resolved: That in conveying to the World Health Organisation appreciation of its decision to admit the World Confederation for Physical Therapy into official relations, the hope be expressed that the services of the Confederation will be utilised in the planning and execution of rehabilitation programmes for the sick and disabled.

UNITED NATIONS CHILDREN'S FUND.

Resolved: That an expression of appreciation be extended to the United Nations Children's Fund for its accomplishments in assisting the countries of the world to solve problems faced by their handicapped and other needy children; and that the members of the World Confederation for Physical Therapy be requested to co-operate in all possible ways with activities related to UNICEF in their respective countries.

INTERNATIONAL SOCIETY FOR THE WELFARE OF CRIPPLES.

Resolved: That sincere thanks be conveyed to the International Society for the Welfare of Cripples for their continued interest in the World Confederation for Physical Therapy and co-operation in its efforts to improve the physical therapy services available to the disabled.

AMERICAN PHYSICAL THERAPY ASSOCIATION.

Resolved: That the grateful thanks of the World Confederation for Physical Therapy be conveyed to the American Physical Therapy Association and its President, Mary Nesbitt, for the devoted efforts of the Board of Directors of the Association, its National Office Staff, members of the New York District of the New York Chapter and of Catherine Worthingham, Chairman, and Members of the Congress Planning Committee.

CANADIAN PHYSIOTHERAPY ASSOCIATION.

Resolved: That a warm expression of appreciation be conveyed to the Canadian Physiotherapy Association for their generous hospitality which provided a welcome opportunity for overseas members to meet their colleagues in a social atmosphere.

CORRECTION.

World Confederation for Physical Therapy.

The Editor apologies for the mistake in the caption attached to the photograph appearing in the January issue. It should read "The past and present Presidents Miss Elson (U.S.A.) and Miss Griffin (Gt. Britain) with Mrs. S. Coleridge of Sweden at that time Second Vice-President of the Confederation.

POST IN PAKISTAN.

1st March, 1957.

Post in Pakistan under World Veterans' Federation.:

This post is an important one and it is essential that applicants should be senior physical therapists with experience in the training of students.

Job description of Physical Therapist for Pakistan Demonstration centre.

General Field.—Rehabilitation of the handicapped.
Special field.—Physical Therapy.
Duration.—2 years.
When required.—As soon as possible.
Duties.—Under supervision of the Medical Director.

(1) To organise a physical therapy department at the Military Hospital in Lahore, to serve the needs of the hospital and the Limb Fitting Centre.

(2) To plan and conduct regular physical therapy courses for suitable local students with the aim of establishing eventually a formal physical therapy school.

(3) To be available for consultation concerning the development of the physical therapy in Pakistan as part of the rehabilitation service.s

Qualifications.—Certified physical therapist, with considerable experience of work with patients suffering from orthopaedic and neuromuscular disabilities. Experience in organisation and supervision of physical therapy departments desirable; teaching experience essential.

Language.—English.

Further enquiries and applications should be made through the General Secretary: S.A.S.P., P.O. Box 11151, Johannesburg.