Proprioceptive Facilitation Therapy for Paralysis.

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(International Congress Lecture)

WE know that if a person has paralysis from actual destruction of tissue in the central nervous system he cannot be cured. The main reason for this is that this tissue has become so highly specialized that it has lost the ability to regenerate. Any nerve cells or nerve fibres in the brain or spinal cord which have been destroyed are therefore lost permanently. This accounts for the permannent paralysis resulting from poliomyelitis, in which nerve cells in the spinal cord are attacked; for the permanence of paraplegia from severance of the spinal cord; and for the permanent loss of motor function in hemiplegia, cerebral palsy and multiple sclerosis, in which nerve pathways of vital importance to voluntary motion are destroyed. Whatever spontaneous recovery does occur can be accounted for to a considerable extent by reversible tissue injury rather than destruction.

If loss of nervous tissue is permanent how can we expect to accomplish anything by treatment of paralysis? Are we tilting at windmills in our bright new field of rehabilitation? You know very well, of course, that patients with paralysis of various types can be greatly benefited by neuromuscular rehabilitation. But there are many sceptics, and confusing controversies still rage. It is therefore of the greatest importance that we in the field of rehabilitation clearly understand what we can and cannot accomplish through therapy, and why. It is also essential, if we are to convince the sceptics, that we clarify the basic principles of treatment and utilize the most effective techniques for recovery from paralysis.

We must shift our focus from pathology to physiology, for while a desturctive lesion of the central nervous system is permanent and irreversible the resulting loss of motor function may nevertheless be significantly improved. We must admit realistically that even with intensive prolonged therapy using the best available therapeutic techniques we can never achieve complete restoration of function in serious paralysis, and usually a great deal of paralysis persists despite our best efforts. On the other hand, in spite of these limitations, the contribution of rehabilitation to the patient with paralysis is so valuable that there can be no doubt of the increasing importance of this new branch of medicine.

One must recognise that therapy is necessary in a patient disabled by paralysis not only to get him better but also to prevent him from getting worse. The prolonged inactivity enforced by the paralysis results in serious decline in function. This is most evident in the well-known muscular atrophy of disuse, but inactivity can also bring about contracture and disturbances of circulation. Failure to stand and walk for a long period can lead to osteoporosis and fragile bones as well as formation of stones in the urinary tract. The motor mechanisms in the central nervous system also deteriorate with disuse, resulting in decreased voluntary control and co-ordination, disuse tremor, and greater fatigue. Even primitive reflexes show decline from inactivity; examples include the deterioration of reflex adjustment of blood pressure in the sitting and standing positions from prolonged bed rest; decreased function of postural reflexes for sitting and standing balance. In addition, inactivity seriously affects general health, such as appetite, bowel regulation, resistance to infection, &c. Prolonged inactivity has particularly devastating effects on mental health, exaggerating regressive tendencies such as dependency, increasing depression, and affecting emotional stability.

Activity of the neuromuscular system is essential to prevent or overcome the undesirable effects of inactivity. Each specific part of the neuromuscular mechanism must have sufficient activity to prevent disuse: use of the arms will not prevent the effects of inactivity in the legs, nor will activity of the biceps necessarily avoid disuse of the triceps.

One of the goals of the rehabilitation programme must be not only to prevent or eliminate the effects of disuse but also to ensure that deterioration from inactivity will not occur in the future after the patient discontinues treatment. For this reason, taking care of oneself, walking, and other activities have more than their obvious practical significance but constitute daily therapy which the patient can perform himself to prevent disuse. In certain cases, continued specific home-therapy programmes, usually done by the patient himself but if necessary with some assistance from a member of the family, may be essential to maintain function. In addition, the rehabilitation programme must include training in habit patterns that will utilize all of the available and potential neuromuscular function that is left so that in various routine daily activities each specific part of the neuromuscular system is as active as possible. As an example, where possible, walking should be encouraged, utilizing the hip flexors rather than allowing substitution by the quadratus lumborum, so that the habit pattern of gait which is developed does not allow disuse of the hip flexors.

Just as inactivity is harmful, activity is beneficial, and can be carried far beyond mere prevention of the undesirable effects of inactivity. In fact, activity of the neuromuscular mechanism is undoubtedly the single most important therapeutic procedure available for restoration of motor function in paralysis. In addition to producing hypertrophy of the muscles, neuromuscular activity has a striking effect in improving endurance, voluntary control and co-ordination, and decreasing synaptic resistance for various essential motor habit patterns. It improves the functioning of reflexes as well as voluntary motion. Also, it brings about improvement in circulation, range of joint motion, and general health. A well-considered programme of neuromuscular activity with a realistic rehabilitation goal has striking beneficial effects on mental health.

Neuromuscular activity can be beneficial in improving function in patients with paralysis in several specific ways:

1. In a patient with weakness of elbow flexion, for example, therapeutic activity can increase the power and endurance of this motion considerably with practical benefit in reduction of disability. While there is evident muscle hypertrophy and the associated improvement in chemistry of the muscle, this is but one manifestation of an overall neuromuscular process in which the improvement in the nervous mechanism is inseparable from that in the muscle. In other words, elbow flexion becomes stronger in voluntary motion not only because of muscular hypertrophy but also because of decreased synaptic resistance in the voluntary pathway to the anterior horn cells. This results in better voluntary control, co-ordination and endurance as well as

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power. It also brings about greater ease of development of skilled patterns of voluntary motion incorporating elbow flexion.

2. Training of essential habit patterns of motion by repeated daily activity under supervision is essential for proper posture and gait and other activities. Daily repetition of transmission of nerve impulses in a specific pattern brings about gradual reduction of synaptic resistance and the formation of habits. Habits can become very strongly fixed, as witness the signature by which people can be identified. In addition, therapeutic control of activity can eliminate substitution and overcome muscle imbalance, thereby preventing harmful patterns leading to deformity. In many cases of severe disability specialized devices are required for effective training in practical self-care, ambulation and other skilled activities.

3. Potential function in dormant neurons can be developed to an overt level for practical use. In upper motor neuron lesions, for example, the anterior horn cells and their axones to the muscles are all intact. The deficiency is in the corticospinal pathway to the spinal cord. Because a number of other, extrapyramidal, pathways can also send impulses to the anterior horn cells, it is possible through therapeutic activity of the neuromuscular mechanism to develop substitute pathways from the brain by means of which many of the dormant anterior horn cells can be excited to function. In this way, apparently zero muscles can be stimulated to sufficient activity so that they can again serve a useful purpose. This fundamental process by means of which another pathway in the central nervous system takes over the function of one that is lost is called 'Compensation.' While this can and does occur to a limited extent spontaneously in man, development of compensation mechanisms can be tremendously increased by effective therapy. Once the synaptic resistance is decreased sufficiently and the dormant neurons can be excited in routine habit patterns, the restoration of function becomes permanent.

Detour pathways to dormant motor neurons are also of fundamental importance in poliomyelitis. While many anterior horn cells may be destroyed, others remain dormant, probably because of damage to the switchboard mechanism of the internuncial neurons of the spinal cord. It is now well established that the corticospinal tract does not end directly on the anterior horn cells, but terminates on the internuncial neurons, which carry the excitation to the anterior horn cells. Therapeutic activity of the neuromuscular system can stimulate these dormant motor neurons and develop useful detour pathways through the internuncial switchboard to excite the anterior horn cells and restore them to useful function.

Such dormant neurons for so-called 'zero' muscles have been restored to useful activity after as long as 40 years of paralysis in cases of both upper motor neuron and lower motor neuron lesions. This indicates that while inactivity is a serious deleterious influence it is not insuperable, and can be overcome by effective therapy after the lapse of many years.

4. In patients who have been allowed to develop limitation of joint motion the contracture interferes with range of active motion and also with full utilization of the remaining function of the paralysed muscles at that joint. It also interferes with utilization of natural patterns of motion and development of correct habit patterns. Full range of passive motion may also be essential for certain activities even though the muscles at that joint are completely paralysed. Whenever possible, it is preferable to develop range of motion through active muscular exercise rather than passive stretching. However, passive stretching is frequently an essential element in therapy for rehabilitation and should be instituted early to prevent contracture. In late cases, if passive stretching fails, it may be necessary to resort to orthopaedic surgery to eliminate contracture.

The basic process by which contracture occurs is of considerable interest. It is now known that many tissues of the body are undergoing continual change with death of some cells and replacement by new ones. Thus, the static structure of skin and bone is based on a continuous dynamic process of cell change and replacement. The same is true for connective tissue, which also apparently always assumes the extensibility which is applied to it in actual movement. In other words, contracture develops in most cases of paralysis not by a pathological process of scarring but by the normal process of change in connective tissue, which is not made fully extensible by routine motion. On the other hand, where injury and inflammation and edema are superimposed, as in fractures, scarring occurs in addition to develop contractures more rapidly.

5. A major factor in neuromuscular function in upper motor neuron lesions is spasticity. Spasticity is based on hyperactive stretch and postural reflexes which are no longer held in check by the normal inhibitory impulses from the brain. This results in resistance to passive motion and seriously interferes with voluntary contraction of antagonists, both mechanically and through abnormal influences on the nervous mechanism of volitional movement. It also affects patterns of movement and may encourage contracture and deformity. Spasticity may also cause insecurity in balance and gait and diminish self-care.

While drugs and sometimes surgery may be useful to relieve spasticity, one of the most important therapeutic procedures is neuromuscular activity. Relaxation of spasticity can be brought about through development of power and active range of motion in the antagonists by a process of reciprocal inhibition. Spasticity is decreased by development of compensatory inhibitory pathways to replace the inhibitory action of the damaged corticospinal tract, in the same way that compensatory excitatory pathways can be developed to substitute for the loss of the voluntary motor tract. Also, use of natural patterns of movement and training in correct habit patterns help to overcome spasticity. As improvement occurs, the greater relaxation of the spastic muscles becomes permanent and is maintained by the habit patterns of activity.

Recently we have studied several other therapeutic measures which appear to be effective in diminishing spasticity. One is faradic stimulation of the antagonist. This is an application of Sherrington's experiment on the decerebrate animal in which he showed that electrical stimulation of the central end of the cut nerve to the hamstrings brought about immediate relaxation of the spastic quadriceps. The faradic stimulation is applied in combination with passive movement through the entire range in diagonal spiral patterns. Another reflex method of relaxation of spasticity has been the use of cold hydrotherapy. The application of water at 50° F. for five minutes to the spastic foot and ankle has brought about relaxation of the spasticity not only in the local area but also in the spastic muscles throughout that extremity. The mass flexion reflex of the lower extremity also helps to inhibit extensor spasticity.

Because of the therapeutic value of neuromuscular activity for restoration of motor function in praralysis, the quantity and types of motor activity and their relative efficiency are of the greatest significance for rehabilitation. This is particularly important because recovery of motor function in cases of paralysis is, at best, difficult and limited and takes a long period of time. Since considerable activity is necessary merely to prevent or, more usually, to overcome disuse, and a great deal more activity is necessary to bring about actual recovery of function, it would seem desirable that the patient be active throughout the day to achieve the most effective recovery. This type of intensive therapeutic programme is carried out routinely at the Kabat-Kaiser Institute. Elsewhere, many patients receive too little activity in the course of each day. Patients with poliomyelitis, for example, even many months after the

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onset of the disease, often spend practically all of their time in bed and have therapeutic activity for at most an hour a day. This level of activity would be insufficient to prevent disuse in many of the affected muscles. The lack of confidence of many members of the medical profession in this type of therapeutic regime is understandable since the results are questionable, except for spontaneous improvement and maintenance of range of passive motion.

The main reasons given for this programme of limited activity are that excessive activity and excessive fatigue are harmful for paralysed muscles and that over-activity leads to inco-ordination and deformity. These arguments stem from the concepts of the past, before the recent rapid development of neurophysiology. It is obvious that they do not take into account the tremendous importance of disuse in deteriorating neuromuscular function. Also, this regime originated in a period when rest was held in much higher esteem as a therapeutic procedure than it is today. In recent years the dangers of rest in bed have been emphasized, and early activity and ambulation are accepted procedures following surgery, major illness or pregnancy. There is no rational basis for the argument that fatigue is harmful in a properly regulated and supervised intensive neuromuscular rehabilitation programme. Neuromuscular fatigue is to a large extent central, occurring at synapses, and is rapidly and completely reversible. Intensive activity has been applied in thousands of cases with no harmful effects and with much more rapid recovery of function than with the programme of limited activity. In no instance has intensive activity of paralysed muscles caused anything but beneficial effects on the muscle and the neuromuscular mechanism. This is true not only for power, endurance and muscular hypertrophy but also for voluntary control and co-ordination as well as development of correct patterns of motion.

Furthermore, the programme of neuromuscular activity must, to the greatest extent possible, be maximal activity. This has been the type of programme we have carried out at the Kabat-Kaiser Institute, and contrasts with the usual therapeutic programme. In most instances, the usual therapeutic programme, in addition to being limited in time, is also limited in intensity of activity during that time. This older programme is based on contraction of isolated muscles in assistive motion, progressing only very gradually to motion against gravity and then against resistance. It is also based on avoidance of stretch and of fatigue, with a large part of the therapy time devoted to passive motion.

In order to understand what is happening in therapeutic exercise one must realize that the unit of function of the neuromuscular system is the motor unit, consisting of the anterior horn cell and a hundred or more muscle fibres which it innervates. This unit contracts 'all or none' or, in other words, it either responds in a maximal contraction or does not respond at all. It is the excitation bombarding the anterior horn cells from higher centres and various reflex centres which determines whether or not an anterior horn cell will discharge and bring about an 'all-or-none' contraction of its muscle fibres. In this mechanism the muscle fibres themselves function entirely automatically and have no choice but to contract when the excitation reaches them through the motor nerve fibre. The muscle fibres cannot even vary the strength of contraction but merely can respond maximally. It is therefore ludicrous to talk about 'muscle re-education,' since the determining factors are all in the nervous mechanism and the therapeutic effects of excitation of motor neurons result automatically in muscular hypertrophy. The focus of the neuromuscular re-education programme must therefore be effective excitation of the motor centres rather than concern for the muscle directly.

In passive motion no contraction of motor units occurs. In assistive motion only a small percentage of available motor units discharge, since the stimulus to the anterior horn cells is very weak. Repeated assistive motion excites only the same few anterior horn cells which have a low threshold of excitation, causing contraction of the same small number of motor units. What occurs, then, over a period of time, is activity in a small part of the muscle, which is beneficial; but complete inactivity in the rest of the available motor units of the muscle, which is harmful because of disuse. Because of the small proportion of total time spent in therapeutic activity and because a majority of the motor units are kept inactive even during this activity, progressive disuse is frequently inevitable in spite of this type of therapy.

In order to stimulate every possible anterior horn cell of a paralysed muscle in each effort maximal excitation is necessary. This, to us, is the desirable therapeutic approach. One obvious method to increase excitation in the motor centres is application of resistance, and we use resistive exercises routinely. By applying maximal resistance it can be shown in electromyographic studies that there is a tremendous increase in the action potential of the contracting muscle, indicating a marked increase in the number of discharging motor units. We have worked out technical procedures by which manual resistance can be applied even to so-called 'zero' muscles with great benefit.

Utilization of resistance as a therapeutic tool is of great significance, since this procedure harnesses one of the most fundamental mechanisms of the neuromuscular system. Muscle tissue itself responds to increased length and tension by greater contraction. This is true for all muscle and is the basis for Starling's 'Law of the Heart,' by which the heart muscle performs more work when it is under greater tension. The same principle is applicable to skeletal muscle through a powerful neuromuscular mechanism. Resistance stimulates afferent proprioceptive discharges into the central nervous system, which greatly increase excitation at motor centres and thereby excite many additional motor units. In fact, this mechanism is of great importance in all voluntary motion, since it automatically ensures the correct power of muscular contraction, adjusting quickly without conscious effort to the weight to be lifted. Gellhorn has shown that resistance is effective in increasing the muscular contraction resulting from electrical stimulation of the motor cortex in the monkey, through the increased excitation brought about by this proprioceptive facilitation mechanism. Resistance is powerful enough to increase excitation in the monkey's motor cortex sufficiently so that a subthreshold cortical stimulus can cause muscular contraction. This experiment is comparable ot our application of resistance to facilitate contraction of so-called 'zero' muscles in patients with paralysis.

Another tenet of the widely accepted routine is careful isolation of contraction to a single muscle in therapeutic exercise. Any spread of the contraction to other muscles is considered harmful and the therapist attempts to eliminate it. Such spread of excitation is called "substitution' or 'incoordination.' We regard this approach as unsound physiologically and have discarded it entirely. It should be pointed out that in every day activities we practically never use a single muscle in voluntary motion, but rather use complex patterns of motion including the prime mover, the synergists and the fixating muscles as well as contraction in more distant muscles for compensating changes in posture, &c. Application of resistance automatically prevents contraction of a single muscle since it brings abouut greater excitation in motor centres with spread of excitation or 'irradiation' in specific patterns of synergistic muscles. It is therefore obvious that isolated muscle contraction is incompatible with maximal excitation of the neuromuscular mechanism, and maximal activity is to be preferred.

The attempt to isolate activity to single muscles is based on the misconception that spread of excitation to other muscles is evidence of 'incoordination' and is abnormal and harmful. The truth of the matter is that irradiation in patterns is a basic characteristic of the normal neuromuscular mechanism, which is applicable not only to

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voluntary motion but also to reflexes, and was well described by Sherrington. As excitation increases with greater resistance, irradiation occurs automatically and brings in additional muscle groups to perform the greater amount of work required. This is another example of the important automatic mechanisms which are essential in so-called 'voluntary movement.'

There is considerable scientific evidence for the fundamental nature of mass movement patterns in the functioning of the neuromuscular system. Coghill concluded, from investigations on the development of amblystoma, that the earliest movements are perfectly integrated total patterns, within which partial patterns later arise as the basis for more discrete movements. In the human newborn and developing infant, co-ordinated mass-movement patterns are also prominent in motor behaviour. In many activities in heavy work and sports, certain diagonal spiral patterns are applied routinely by people all over the world. These are evidently natural patterns of motion based on the patterns of anatomical distribution of synergistic muscles and on the associated patterns of proprioceptive facilitation. Examples include the patterns evident in chopping wood, playing golf, tennis, using a scythe, throwing a ball, using a shovel, &c. Also, Gellhorn has shown that a threshold electrical stimulus applied to a single excitable point on the motor cortex of the monkey produces contraction in a synergistic pattern of muscles throughout an extremity rather than in a single muscle. Since a threshold stimulus is the minimal stimulus necessary to excite the cortical focus at all, widespread contraction cannot be attributed to spread of the electrical stimulus over a wider area of the cortex.

We have shown in therapeutic exercise in patients with paralysis, and Gellhorn has shown independently in experiments on electrical stimulation of the motor cortex in the monkey, that stretch and resistance in mass movement patters have a powerful facilitating effect on the motor centres. We have therefore discarded isolated motion, and routinely apply resistance in diagonal spiral mass-movement patterns or combinations of mass-movement patterns for greater facilitation of the motor centres and greater excitation of the motor units. Manual resistance has also been used in mat work in primitive total body patterns. In other words, instead of worrying about the natural process of irradiation and considering it harmful, we not only allow it to occur but harness it as a powerful facilitating mechanism to accelerate recovery of neuromuscular function. In addition to the advantage afforded by the facilitation from resistive exercise in mass-movement patterns for the excitation of a greater number of motor units in the paralysed muscles, these techniques also allow the activity of many muscle groups at one time. This greatly increases the economy of utilization of the physical therapist's time, and thereby the practical effectiveness of the rehabilitation programme.

Besides manual resistance, resistive exercise in mass-movement patterns is performed in the gymnasium with pulleys and dumb-bells, and anti-gravity exercise in total body patterns is carried out by the patient himself under supervision on mats. Resistive exercise in mass-movement patterns has also been applied successfully in occupational therapy.

Stretch of the muscles can also be used for proprioceptive facilitation in accelerating restoration of motor function. It was found that, particularly in flaccid paralysis, contraction of paralysed muscles in the stretched range was more effective. Not only stretch of the prime mover but also stretch of other muscles in the mass-movement pattern helped to facilitate the response. This facilitation mechanism was also demonstrated by Gellhorn in experiments on electrical stimulation of the motor cortex in monkeys. Rather than avoiding stretch of paralysed muscles, as in the old treatment routine, we use stretch as a standard technique of proprioceptive facilitation.

Various reflexes which we have used as facilitation techniques in treatment of paralysis include: the mass flexion reflex of the lower extremity (von Bechterew); the tonic neck reflexes; the grasp reflex; the positive supporting reaction; balancing reflexes; the gag reflex, and others.

Training in balancing illustrates the role of reflexes in facilitation. Applying maximal resistance in one direction at a time, the standing patient attempts voluntarily to prevent being pushed off balance. But in the process powerful balancing reflexes are stimulated which facilitate the voluntary motor response so that 'zero' muscles may be excited. In addition, there is undoubtedly facilitation, by the voluntary resistive exercise, of the balancing reflexes themselves, just as the knee jerk is facilitated by clasping the hands and pulling apart strongly (the Jendrassik manoeuvre). In other words, both the reflex and the voluntary motion, which are closely interrelated, are facilitated in the resistive exercise. This procedure also accelerates training of the balancing patterns for standing, which are of immediate practical value for ambulation. This technique has been applied for standing balance, standing balance with crutches, braces, &c., sitting balance, and kneeling balance.

Another important mechanism for facilitation in therapeutic exercise is the alternate voluntary contraction of antagonists against resistance. This is based on Sherrington's principle of 'successive induction.' He found that, *immediately after stimulation* of the flexor reflex, the extensor centre was hyperexcitable. This principle is used for greater power in a variety of everyday activities, such as pitching in baseball, chopping wood, boxing, using a scythe, &c., in which the antagonist motion is carried out immediately preceding the main motion in a continuous sequence. We have applied this principle of facilitation by isotonic alternation of antagonists against resistance, as well as by isometric alternation of antagonists against resistance (which has been designated 'ryhthmic stabilization'). These techniques are particularly helpful when the agonist is paralysed, but the antagonist is relatively uninvolved.

The close relationship of antagonist muscles to muscular relaxation was demonstrated by Sherrington in experiments on 'reciprocal innervation.' *During contraction* of the agonist, the antagonist is relaxed. Also, the stronger the agonist contraction the greater is the inhibition of the antagonist. We have applied this principle to facilitate inhibition of spasticity. For example, in relaxation of a spastic hip adductor the technique is as follows: voluntary contraction of the hip adductor pattern against maximal resistance in the stretched range, then voluntary relaxation of the adductor, followed immediately by voluntary contraction of the hip abduction pattern against resistance. In this technique direct relaxation and reciprocal inhibition are applied simultaneously to the spastic muscle. Also, proprioceptive facilitation is employed to enhance the inhibitory effect. This procedure is much more effective in reduction of spasticity than the usual relaxation methods.

For maximal excitation all of the facilitation techniques may be combined and used simultaneously. Thus, rhythmic stabilization may be applied, using maximal resistance in a mass-movement pattern emphasizing the stretched range of the paralysed muscle groups. In this way we apply the principle of 'summation' of excitation, which is one of the fundamental principles of activity of the motor centres established by Sherrington.

It must be emphasized that these techniques require great skill on the part of the physical therapist, and that at least several months of specialized training is necessary for successful application of proprioceptive facilitation therapy. Also, these methods require close medical supervision by specially trained physicians. Only expert individual physical therapy with proprioceptive facilitation can develop the full potentialities of 'zero' or severely paralysed muscles.

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Techniques of propioceptive facilitation are particularly advantageous for neuromuscular rehabilitation of infants and young children. In such cases co-operation in the usual therapy programme is extremely difficult. On the other hand, much better co-operation acn be obtained in proprioceptive facilitation therapy, using primitive total body patterns on mats, balancing reflexes, stretch in mass-movement patterns, tonic neck reflexes, &c., for facilitation along with maximal resistance. Training of such children, who have never stood or walked before, in ambulation with braces and crutches is also accelerated by these techniques. Recently, we were able to give daily therapy successfully, beginning at the age of six weeks, to a child with paralytic poliomyelitis affecting the right arm and leg. Obviously, voluntary co-operation was impossible at this age, but reflex patterns of movement resulted in significant improvement. It is therefore possible, with these new methods, to begin effective therapy at an earlier age in cases of poliomyelitis, cerebral palsy and other types of paralysis in infants, with beneficial results.

Techniques of proprioceptive facilitation can not only be helpful in restoring power and endurance of paralysed muscles, but can also accelerate the training of motor skills. Training depends on the formation of functional pathways in the central nervous system through gradual reduction in synaptic resistance. Synaptic resistance is undoubtedly reduced more rapidly as a result of the strong excitation in the motor centres produced by proprioceptive facilitation. We have had extensive experience in training of patterns of balance against resistance. Application of proprioceptive facilitation for a variety of self-care activities, such as getting out of the wheelchair to stand on long leg-braces, moving from bed to wheelchair, dressing, feeding, &c., has also accelerated training of such skills in patients with paralysis. These methods are also applicable for correction of posture, including suitable scases of paralytic scoliosis.

While proprioceptive facilitation therapy has been applied originally and most extensively to rehabilitation of paralysis these methods have demonstrated their value in many non-paralytic conditions. We have had considerable experience in the use of these techniques in the treatment of traumatic arthritis, hypertrophic arthritis, chronic rheumatoid arthritis and chronic bursitis, chronic backache, and follow-up treatment of fractures and other injuries. Proprioceptive facilitation therapy has been applied following such surgical procedures as arthroplasty, release of contracture, tendon transplantation and other operations, and in the majority of these cases the improvement in range of motion, power and endurance of the muscles, and relief of spasm and pain has been much better than with the usual therapy methods. For successful results a careful prescription of the correct procedures of proprioceptive facilitation therapy is essential.

Proprioceptive facilitation is not necessarily limited in its application only to neuromuscular therapy. It should also prove to be of value in accelerating the training of many types of motor skills in normal individuals. These methods are just as applicable to normals, since they harness fundamental functional mechanisms of the neuromuscular system. Indeed, the response should be much better in the normal than in the patient with serious permanent damage to the motor centres. We have found these techniques useful in correcting habit patterns of posture and gait in normal children and adults. We may, perhaps, be able in the future, by applying proprioceptive facilitation, to accelerate motor learning and create superior skill in such diverse activities as typing, writing, playing the violin, driving a car, playing tennis, or ballet dancing.

GENERAL

A letter has been received from the Minister of Health informing the Society that he intends introducing a Supplementary Health Services Bill at the next session of Parliament.

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The Society is having Christmas cards printed with the badge on the front, and a Christmas and New Year greeting in English and Afrikaans on the inside. These are available on application to the Secretary, P.O. Box 11151, Johannesburg, Price 6/- per dozen, including envelopes.

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A private practitioners group is being planned, for members of the Society only, to exchange ideas and problems which may affect this group in particular. Will those interested please write to Mr. M. D. Oliver, Room 33, Adderley House, 80, Adderley Street, Cape Town.

The metal badges of the Society are now ready. They are made of sterling silver and are about 1-in. × ¾-in. in size, with the pattern in royal blue and silver. Members of the South African Society of the Physiotherapists are the only people entitled to wear this badge. If members wish to buy one, price 10/- each, they must submit their names together with the money, to their local Branch Secretary.

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