

PHYSIOTHERAPY TREATMENT for a PATIENT with a HEAD INJURY

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The World Confederation for Physical Therapy in 1963, following the fourth congress, published a series of articles on traffic accidents. The statistics from the World Health Organisation, which are quoted in these articles, indicate that 100,000 people in the whole world are killed each year by traffic accidents. For every death 30 to 40 people are injured and one-third of these are severely injured. The article on Cranio Cerebral injuries, by K. Vaernet, senior surgeon of the Neuro-Surgical Department, Rigshospital, Copenhagen, states that the number of people with head injuries admitted to the Neuro-Surgical departments of the Copenhagen area is now nearly three times as large as it was 15 years ago. To those of us who travel to work each day by motor car, it is apparent that motor traffic is increasing in South Africa just as it is increasing all over the world and the accident rate is increasing in South Africa just as it is elsewhere. New legislation in the United States regarding safety measures to be incorporated into the design of motor cars is the latest result of much research. However at the present time the incidence of head injuries continues to rise and it is clear that physiotherapists will be called upon more and more frequently to treat such cases.

Treatment of a patient with a head injury is in any case complicated and challenging. In addition, however, no two head injuries show exactly the same symptoms because the symptoms will vary according to the position and the degree of the damage sustained. Patients with brain stem damage which involves the Reticular System or the Cerebellum to a greater or lesser extent, show a very different distribution of hyper or hypotonia and for this reason it is impossible to write a general description of the treatment of head injuries. I am therefore going to describe a particular case whose progress I followed for 18 months from the time he recovered consciousness sufficiently to have the tracheostomy tube removed and began to have daily treatment in the physiotherapy department of a general hospital.

I will describe the physiotherapy approach and some of the techniques which were used and will try to give a critical assessment of this patient's response to different modalities and techniques. Although the techniques described here have been adapted to the needs of one particular patient, they have nevertheless points of general application.

This article is essentially a description of treatment by means of a sensory motor approach which combines several techniques. The Bobath approach was used as well as Proprioceptive Neuromuscular Facilitation. Ice packs were used in an attempt to reduce spasm and Rood type sensory stimulation of certain inhibited muscle groups was also used. The treatment was carried out in close co-operation with an Occupational Therapy Department and the Occupational Therapists concentrated mainly on the space perception problems, on memory training and on re-education of writing and fine finger movements. Later the patient was sent for woodwork training. The patient was also assessed by a Psychologist who rendered valuable assistance to the Physiotherapy Department regarding the handling of the patient.

MEDICAL HISTORY

The patient was a 17-year old boy who was admitted to hospital on 9th May, 1965, deeply unconscious, following an accident in which his moped was struck by a car. The final diagnosis was head injury with external hydro-cephalus in the right Temporal region.

On admission the patient was deeply comatose and responded little to painful stimuli.

Blood Pressure was 140/90 and the pulse rate 112.

The right pupil was larger than the left but reacted to light.

There was a mild bi-lateral papilloedema which produced blurring of the medial margins of the discs and filling of the optic cups.

A left facial paresis was noted.

All limbs were markedly spastic but some movement could be obtained from the right arm on painful stimuli.

The reflexes were brisk but equal on both sides.

The abdominal responses were absent and both plantar responses were extensor.

The patient had bi-lateral pes caves with hammer toes and short Tendo Achilles, which were obviously of long standing.

Abdomen, Chest and Cardio-Vascular system were clinically normal.

There was a fracture of the left clavicle with considerable overlap. This fracture was not reduced because of the severity of the patient's condition.

On admission a sub-dural haematoma was diagnosed and burr holes were performed, one above the left ear at the level of the Sylvian Fissure and one a few centimetres off the mid-line immediately in front of the right motor cortex.

On 25th May, two weeks after the accident, another burr hole was provided in the right temporal region. The dura was opened to reveal a distended sub-arachnoid space. Incision of the Arachnoid led to copious discharge of Cerebro spinal fluid. However, the underlying brain was slack and pulsed normally. A brain cannula was passed into the Temporal lobe but no haematoma encountered. The Cerebro-spinal-fluid pressure was found to be 90. Following the insertion of a cannula air encephalography produced good ventricular filling with very slight displacement of the ventricles to the left, much less than previously indicated by angiography and this confirmed the impression that the shift was due to external hydrocephalus.

On 7th June, 1965 four weeks after the accident, the state of consciousness seemed to have improved slightly. There was good movement of the right arm but the patient still showed a marked decerebrate rigidity.

On 19th June, 1965 six weeks after the accident, there was no real change in the patient's condition. He was still unconscious.

On 21st July, 1965, ten weeks after the accident, the patient had improved sufficiently to remove the tracheostomy tube. He talked in a whisper but rationally and appeared well orientated. There was good voluntary movement of the right arm and although the right leg was rigidly extended some voluntary movement was present. There was some slight movement of the left side of the body. The left upper limb and both lower limbs still manifested marked hyper-tonia. The neurosurgeon recommended daily physiotherapy treatment and the patient was transferred to a general hospital and at this stage I did an assessment of the patient to determine future physiotherapy treatment.

PHYSIOTHERAPY ASSESSMENT

General Appearance:

The patient had a facial paresis of the left side. He showed an intermittent divergent squint. (It was later ascertained that this squint caused him double vision and this problem received successful surgical attention 18 months later.)

The patient's speech was hoarse and difficult although his breathing was satisfactory and his chest clear. (The hoarseness of his speech was later found to be caused by papilloma of the larynx which had been treated for many years previously.)

Head Control:

It was noted that the patient's head was constantly flexed onto his chest and rotated constantly to the left, but that the position of the head did not seem to affect the muscle tone to any great extent. However, head control was very poor. The patient could really only lift his head up momentarily. The lack of head control affected his ability to balance.

Muscle Tone:

On testing, the right arm and leg showed an increase of extensor tone and the left arm and leg showed a marked increase of flexor tone. In supine positions the trunk musculature showed an increase of extensor tone and in prone positions the flexor muscles were hypertonic. If placed in a wheel-chair the patient slid forwards out of the chair because the stretch on his hamstring muscles in this position caused a reflex mass contraction of his extensor muscles.

The Arms:

The left shoulder was very painful when elevated above 90 degrees. This was thought to be due to spasm of the sternal fibres of the Pectoralis Major and of the Biceps muscles, both of which resisted the movement of elevation. The shoulder joint was also stiff due to the limitation of full range movement. The left elbow could not be extended passively or actively due to spasm of the Biceps muscle and to the patient's complete inability to initiate contraction of the Triceps muscle. The fingers of the left hand were tightly closed, the wrist slightly flexed and Ulna deviated and the thumb adducted. There was little or no voluntary movement of the left arm but the right arm could be moved voluntarily through a full range of movement at each joint.

The Legs:

The left hip and knee showed a loss of extensor movement which varied in different testing positions, but the knee could not be fully extended in any position due to the spasm of the hip flexors and Hamstring muscle group. There was little or no voluntary extensor movement of the left lower limb. Movement of the right lower limb was better, as mass pattern flexion and extension was present. However the limb was markedly inco-ordinate and there was a severe tremor on effort.

The Trunk:

The hypertonia of the trunk caused a limitation of movement of the spine.

Reflexes:

The flexor withdrawal reflex was exaggerated bilaterally but more so on the left than the right. The Quadriceps and the Gastrocnemius and Soleus muscles showed hypertonia on testing and when the patient was placed in a standing position the spasm increased. On contact with the floor the right ankle showed equino-vares. On contact with the floor the left leg withdrew into mass flexion.

Tremor:

The patient showed a tremor on effort which was worse on the right side than the left. The tremor increased markedly and became general if the patient was under duress.

Co-ordination:

The patient's ability to make purposive voluntary movements was virtually nil. He could not move into a weight supporting position on his elbows and he could not sit up or roll over. However, he could carry out simple mass pattern movements with his right arm.

Balance and Equilibrium:

No balance or equilibrium reactions were present but the patient feared loss of balance and felt insecure all the time. Fear of loss of balance increased the spasticity.

Consciousness:

There were brief occasional lapses of consciousness which caused the patient to slump in his chair momentarily.

General Impression:

The patient tired easily physically and mentally and found concentration very difficult. Perseveration of ideas was marked and the patient also appeared to have perceptual difficulties. It was noted that he had been left-handed prior to the accident and would have a problem of laterality due to the fact that the injuries had affected the left side of the body more severely. However, despite all these difficulties he appeared fairly well orientated on a verbal scale and this was later confirmed by the Psychologist's report.

The following plan of treatment was developed.

TREATMENT

The Chest:

Prior to the removal of the tracheostomy tube and before the above physiotherapy assessment was done, the patient was given treatment with a view to keeping the chest clear of an accumulation of secretions, i.e. as dry as possible. The treatment was done daily in conjunction with the nursing staff, just before the routine two-hourly change of position to prevent bed-sores. The patient was treated first in side lying on one side, then in supine lying and then side lying on the other side. In side lying the patient was percussed well over the lateral costal and posterior basal areas. Thereafter the chest wall was firmly vibrated as the patient breathed out and the chest was suctioned during the period of expiration, through the tracheostomy tube. Passive movements of the arm and leg were carried out as fully as possible, but great difficulty was experienced due to the spasm. The passive movements of the arm were done to maintain the mobility of the chest wall as well as the mobility of the limb itself. In supine lying the patient was vibrated first in the lower costal and then in the apical region, suctioning in between as well as at the end. When the patient was turned on to the other side, percussion, vibration and suctioning were repeated, as well as passive movements of the arm and leg. As soon as the patient recovered consciousness he was taught to cough.

When the above physiotherapy assessment was done by the writer, the chest was clear and the breathing good. However, the passive movements of the arm and leg had not been entirely successful due to the difficulties caused by the hypertonia and potential flexor contractures were developing in the left elbow, shoulder and knee. The mobility of the spine was very poor.

General Treatment

When consciousness returned and after the physiotherapy assessment was done, it was decided that the immediate essentials of treatment were:

(a) Head control.

(b) Positioning of the limbs and spine to gain mobility.

The co-operation of the boy's Mother was sought, and he was regularly positioned throughout the day. He was placed in prone lying, as in Fig. 1 with his weight supported on his elbows, his chest supported on a pillow and his feet dorsi-flexed over the end of the bed. He was encouraged to lift his head and look at various centrally placed objects. This position favours extension of both hips and knees and spine but encourages dorsi-flexion of the ankles. In this position the action of gravity and the weight of the patient favours a lengthening reaction in the appropriate flexor muscles. He was encouraged to change his weight from one elbow to another as he looked round the ward, in order to facilitate weight-bearing on the arms with shoulders stable.

At this time the patient was also encouraged to lie prone with his arms extended forwards, as in Fig. 2. In this position the spasm of the Pectoralis Major and of the Biceps muscle of the left arm gradually decreased due to the tension in the muscle causing a lengthening reaction. Thus the spasm was

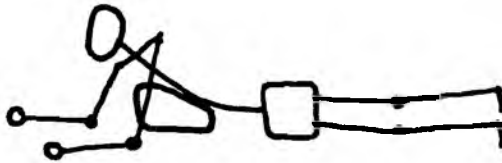


Fig. 1. Prone lying elbow support position. Chest is supported by a pillow. Feet hang down over the edge of the bed.

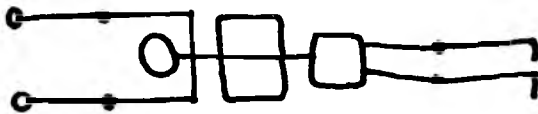


Fig. 2. Prone lying, arms extended forwards. Chest is supported by a pillow. Feet over the bed edge.

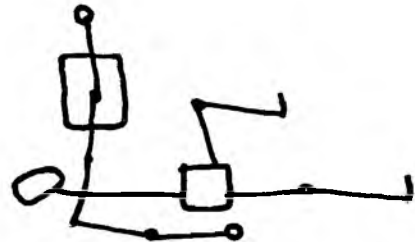
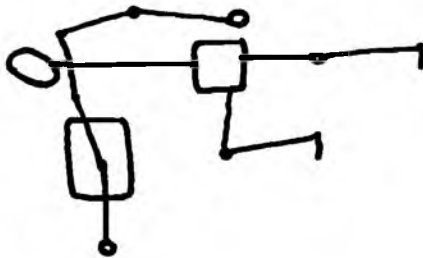


Fig. 3. Side lying on alternate sides. Arm elevated forwards 90 degrees, supported on a cushion. Roll of bandage in the hand. One leg flexed and one extended.

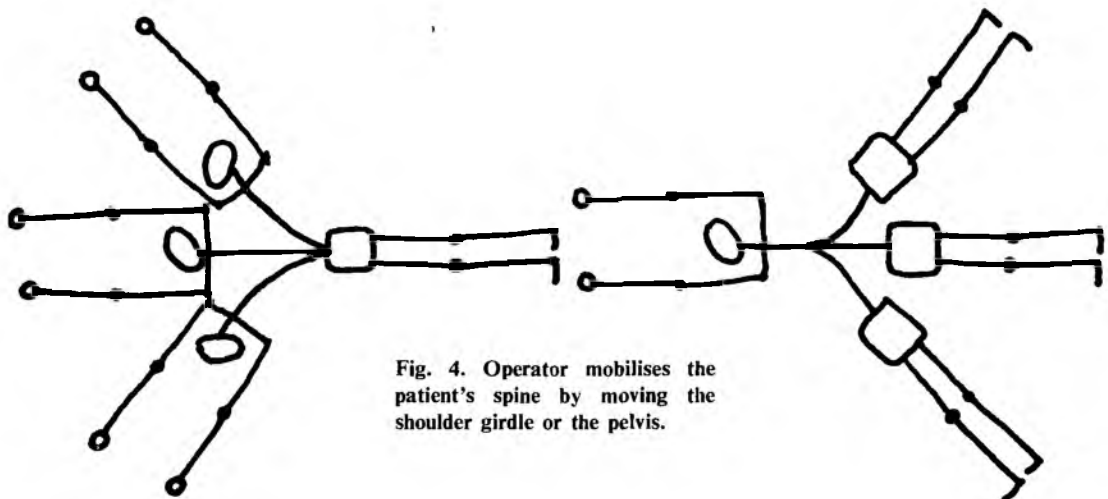


Fig. 4. Operator mobilises the patient's spine by moving the shoulder girdle or the pelvis.

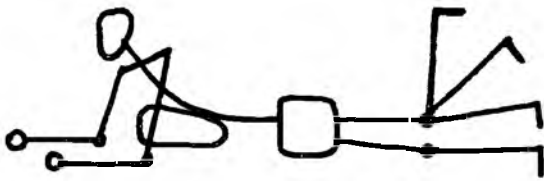


Fig. 5. Prone lying elbow support position. Patient's knee is flexed in various positions and he is asked to hold the position. He is assisted to hold the position by means of sensory stimulation.

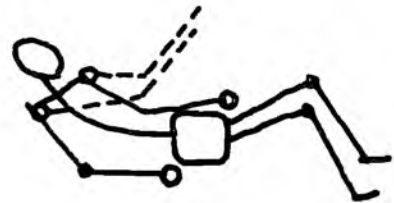
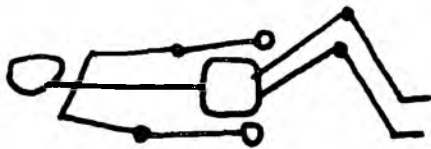
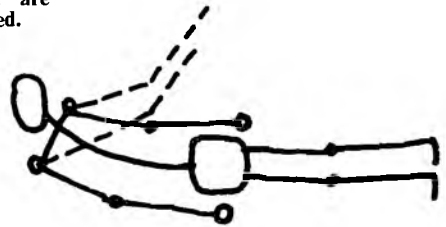
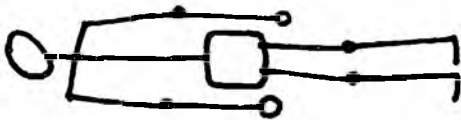


Fig. 6. Facilitation of head control in crook lying position. Patient's shoulder girdle and trunk are flexed, side flexed and rotated.



Figs. 6 and 7. Prone lying position. The shoulders are lifted and the trunk is side flexed and rotated for facilitation of head control. The arms may be grasped in order to facilitate head control.

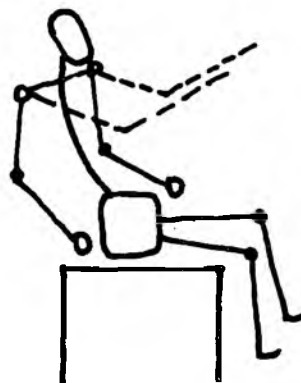
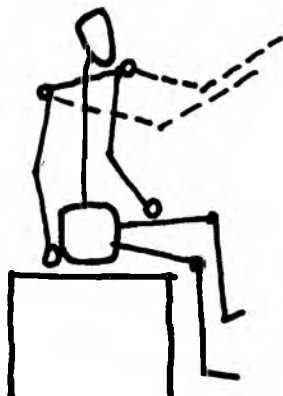
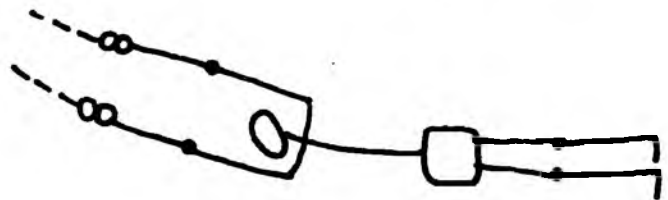


Fig. 8. Patient sits on a stool. Operator grasps the shoulder points and flexes, side flexes and rotates the spine in order to facilitate head control. Gentle shaking movements of the trunk are used to facilitate stabilisation of the head.

relieved and as the patient's tolerance of the stretch on stiff joints increased, full range shoulder and knee movements became possible. However, full range movement of the elbow was not successfully achieved by positioning and this received further attention, as described later.

At this stage the patient was still being turned two-hourly to half side lying on alternate sides. Alternate legs were flexed or extended and the upper arm was elevated forwards 90 degrees and supported on a cushion. In this position the left hand was opened as much as possible by means of a roll of bandage (see Fig. 3).

In the side lying position the shoulder was mobilised in the way described by Bobath, i.e. by grasping the Scapular and moving it forward and back in as big a range as possible. It was also moved slowly passively on the P.N.F. diagonals. This was done in order to normalise the muscle tone before commencing wide arm movements at the shoulder joint. Tapping and stroking of the inhibited muscle groups was also used to normalise the muscle tone before and sometimes during movement of the shoulder and elbow of the left arm. The patient was assisted to reach out and touch certain objects which were placed in different positions each day. At first he was assisted by the operator so that he received the correct sensory impression of the movement, but as he progressed, less assistance was given and more was asked of the patient. The emphasis was on normal movement with normal timing. This was successful as regards the right arm but the spasm and contracture of the left arm made movement difficult. Mobilisation of the spine was carried out daily in prone lying with the arms elevated forwards. With the operator's arm under the patient's shoulders the spine was very slowly first side flexed and then rotated to one side and then to the other. This was repeated from the lumbar end by holding the patient under the legs just above the knees, first side flexing the patient and then rotating the hips very slowly to alternate sides (see Fig. 4). The mobility of the spine and shoulder improved a great deal in a month.

In the prone lying elbow support position the patient's knees were flexed into various positions and the patient was asked to hold the position. Tapping the limb in all directions and proprioceptive stimulation was used to assist the patient to hold in various positions (see Fig. 5).

In supine crook lying, head control was facilitated, as described by the Bobaths (see Fig. 6). That is, the patient was grasped by the shoulders or the elbows and moved in a circular direction combining side flexion and rotation of the trunk as well as flexion of the trunk. When this is done to the normal patient the head automatically attempts to remain in the vertical plane due to the righting reactions. Our patient's head control improved quickly with daily practice.

In prone lying the shoulders were lifted and the trunk side flexed and then rotated to facilitate head control (see Fig. 7). At this stage head control began to improve and new exercises were added and the exercise programme began to be varied daily, as it was throughout the period of treatment. Head control was facilitated with the patient in a sitting position with his legs over the edge of the bed. He was grasped by the shoulder points and gentle shaking movements of the trunk were used to facilitate the patient to stabilise the head. Circling movements of the trunk incorporating side flexion and rotation were also used (see Fig. 8). Head control was progressed in this way through the stages of development, i.e. up to the standing position, as described by the Bobaths. All the facilitation of elbow supporting positions which are described by the Bobaths were used, e.g. Supine lying up to side lying elbow support.

Various sitting positions using elbow support positions were used. The ability to support weight with a stable shoulder improved. However the progression to weight supporting positions with an extended elbow presented a problem because of the patient's complete inability to inhibit the action of the Biceps muscle of the left arm. The patient still could not initiate a contraction of the Triceps of the left arm

and the elbow still could not be extended passively because of the spasm. Elevation of the left arm was still limited. The co-ordination of the right arm was much improved. The patient could weight support on an extended right arm.

Assessment of the Problem of the Patient's Left Arm

The left arm was re-assessed because the progress was not entirely satisfactory and the following points were noted:

- (i) Sensory loss.
- (ii) Contracture of the Biceps.
- (iii) Limitation of movement of the elbow joint.
- (iv) Weakness of the extensors of the elbow, wrist and fingers.
- (v) Difficulty elevating the arm above 90 degrees.

Two to three weeks after the patient commenced treatment he could concentrate sufficiently well for a sensory test to be done on the left arm and hand. Tactile discrimination and stereognoses were found to be defective. However, the neurologist who tested the patient felt that sensation would improve as the oedema of the brain subsided and that further tests should be carried out in the future. Sensory tests were done at regular intervals and it is interesting to note that there has been steady improvement in the results of these tests up to the present time.

The general appearance of the arm was noted. There was considerable wasting of the musculature of the left upper limb. In sitting positions the resting position of the arm was often flexed, adducted and medially rotated. The elbow was flexed and slightly supinated. The wrist was flexed and Ulna deviated and the fingers were tightly flexed. This position became exaggerated if the patient made an effort of any kind.

The following progress was noted. The mobility and stability of the shoulder had improved due to positioning and weight-bearing exercises and the elbow could flex and extend a few degrees voluntarily. The patient could simultaneously flex his wrist and extend his fingers and voluntarily extend his wrist with simultaneous flexion of the fingers.

It was felt that the exaggerated reflex and excessive facilitation of the Biceps and Pectoralis muscles constituted a serious problem and it was decided that Ice-Packs might inhibit the discharge of the spindles of these muscles thereby allowing easier facilitation of the extensors. The Ice-Packs were followed by Proprioceptive Neuromuscular Facilitation patterns that would facilitate the action of the Triceps and the elevators of the shoulder girdle.

Ice-Packs

It was observed that on some days the application of Ice-packs seemed more effective than on other days. If the patient's general temperature dropped and he began to shiver, the spasm was if anything increased. It was found that the results were better if the patient was kept warm in a blanket or even warmed by the use of hotwater-bottles on cold days, while the ice-packs were applied, i.e. an attempt was made to maintain the patient's general temperature at a normal level. This observation is corroborated by results of experiments published in an article entitled "Muscle Spindle Response to Body Heating and Localised Muscle Cooling"—which was published in the *American Physical Therapy Journal*.

The Ice-packs were followed by sensory stimulation in the form of quick stroking, pounding and tapping over the Triceps area and its tendinous insertion.

Proprioceptive Neuromuscular Facilitation (P.N.F.)

Sensory stimulation was followed by the P.N.F. pattern of extension, abduction and medial rotation, as for extension of the elbow. As always the rotator component was strongly stressed, together with strong approximation of the shoulder, elbow and wrist joints.

On commencement of this treatment there was a daily improvement in the patient's ability to initiate a contraction of the Triceps muscle of the left arm and arm balance reactions began to appear on the left side as on the right side when facilitated. At the end of the month the patient could

extend his elbow well against resistance. The Ice-packs were discontinued as soon as the patient could extend his elbow fully voluntarily and could easily be facilitated into a weight supporting position on an extended elbow.

During this period the patient was placed in a side lying position on the right side, the left elbow and wrist were extended as much as possible and the operator placed pressure on the end of the Radius and Ulna while supporting the back of the elbow joint. Strong approximation was applied through the shoulder and elbow joints and the patient was asked to practise thrust movements with the arm at varying degrees of elevation. Slight resistance of the thrust pattern facilitated the extension of the elbow.

The P.N.F. patterns for elevation of the Scapular were found to be particularly effective for strengthening the weak musculature of the left scapular. The patient began to be able to elevate his arm and gained steadily in strength and control.

Because of the original assessment of muscle tone, P.N.F. extensor patterns were facilitated first in the left upper limb and flexor patterns in the right upper limb. As the arm improved all the P.N.F. patterns for the arm were tried. Reversals of pattern and bi-lateral arm patterns were found to be particularly effective for training co-ordination. Many of the trunk patterns were successfully tried, e.g. the patterns for Quadratus Lumborum, but resistance of the patterns of the developmental sequences were not used, because by this time the patient could easily be facilitated by the Bobath method and resistance of these patterns did not seem justified as resistance produced a great increase of associated movements.

Detrimental Associated movements were particularly noticeable with P.N.F. patterns involving the entire body in effort.

As a general rule P.N.F. patterns were started first on the proximal joint of the limb and if the patient was in difficulties with the co-ordination the patterns were broken down into component parts before trying the entire pattern. This often made it easier for the patient because his concentration was not so severely taxed.

Associated Movements

P.N.F. patterns were always carried out with the patient in a Reflex Inhibiting Position, as described by the Bobaths. During the time that the patient was experiencing difficulty with the P.N.F. patterns, because of the weakness and inco-ordination, associated movements were a worrying problem. However as the patient gained strength and co-ordination and carried out the patterns more easily, the Associated movements decreased. However, associated spasm was always noted and counteracted as far as possible by positioning, and sometimes it was necessary for an assistant to hold the limb in a Reflex Inhibiting Position to control an Associated movement. As the patient gained muscle control he was asked to carry out a movement opposite in pattern to the detrimental Associated movement. Usually the Associated movements were most troublesome when the right side was being exercised because they tended to reinforce the flexion already existing on the left side.

Simultaneous Extension of the Wrist and Fingers

In supine crook lying the patient's arm was elevated 180 degrees, turned into full lateral rotation and he was asked to stabilise it in this position with the elbow, wrist and fingers extended as much as possible. The operator applied strong approximation through the wrist, elbow and shoulder gripping as for the flexion, abduction and lateral rotation P.N.F. arm pattern and resisted the patient's attempt to stabilise by pushing the arm down as for the P.N.F. pattern of extension, abduction and medial rotation. Though the patient could not at first open his wrist and fingers simultaneously, he eventually learned to do this by means of the technique described above.

The Problem of Hyperextension of the Patient's Knee in Weight-bearing Positions

As a preparation for walking the patient's balance and

equilibrium reactions had been facilitated in all of the patterns of the developmental sequences, particularly upright kneeling, but as soon as he stood up or attempted to walk the right knee hyperextended and the patient could not achieve a heel toe gait because of the back kneeling and the persistent equino vares at the ankle. This occurred despite the Bobath sensory motor training of the patterns of walking, and the application of Ice-packs on the Quadriceps muscle group and Gastrocnemous and Soleus group. The spasm caused considerable unsteadiness of the patient's stance and gait. He was placed sitting with his legs over the edge of the bed with the operator sitting in front and asked to carry out the P.N.F. pattern of Flexion, Abduction and Medial Rotation as for the knee and Flexion, Adduction and Lateral Rotation as for the knee, and with better ability to inhibit one muscle group for another the back kneeling was controlled and did not worry the patient so much. His balance improved as a direct consequence of better muscular control but it is still not normal.

The Problem of Equino Vares of the Patient's Right Ankle

The patient could carry out all the P.N.F. ankle patterns very well but as soon as summation of stimuli occurred in weight-bearing positions from the positive supporting reflex, the crossed extensor reflex and from approximation of the joint surfaces, the extensor muscles were facilitated and the ankle assumed the position of equino vares.

The patient was placed in a large variety of weight-bearing positions and the toes were tickled in order to facilitate dorsi-flexion of the toes and ankle combined with eversion of the ankle. He was asked to stamp on the medial side of the heel and to dorsi-flex and evert the ankle. An attempt was made to strengthen the abductor muscle group of the hip because they belong to the same P.N.F. synergy as the evertors and dorsi-flexors of the ankle. Many positions were tried that involve a mixture of synergies with the foot in a weight-bearing position. Facilitation of leg balance reactions and equilibrium reactions in weight-bearing positions was frequently repeated without achieving satisfactory improvement and finally in desperation a Forest Town type splint was made out of plaster of Paris. The splint positioned the toes in maximal dorsiflexion with the ankle in maximal dorsi-flexion and eversion. It was worn during rest periods. The aim was to place the over stimulated muscle group on maximal tension in an attempt to produce autogenous inhibition of the stretched muscles. Immediately after resting he was asked to walk in as good a pattern as possible. His gait and his balance slowly improved but it was difficult to decide which technique had helped the patient most.

PROGRESS

Five months after the accident the patient could carry out most of the P.N.F. patterns very well indeed but he still had a slight weakness and inability to facilitate the musculature of the left side. Balance and equilibrium had received much attention but it was still one of the greatest difficulties. The patient had learnt to walk originally with two quadrupod sticks and had progressed to walking with two ordinary sticks but he could not walk unsupported by sticks.

Five months after the accident the Neuro-surgeon wrote this report:

"The patient has done very well. He is able to walk with sticks. He does not complain of headaches. Does get brief lapses of consciousness and falls occasionally, Cranial nerves are intact although the patient is troubled with Diplopia. Limbs: There is some hypertonia in the left upper limb. There is some weakness and a tendency for the limb to fall away. The reflexes are exaggerated. Co-ordination is poor. Tactile localisation and discrimination and stereognoses are not as good on the left as on the right. However, the recovery thus far has been remarkable."

The patient was advised at this stage to take Epineuron and Luminal to control the petit mal attacks which precipitated some of the falls.

Eighteen months after the accident the report stated: "The patient's gait is still unsteady but he walks without sticks. He can jump with both feet together and can go up and down steps without support. However, he cannot jump from one leg to the other, or hop, on the left leg or run. He writes well but rather slowly with the left hand. He still has a loss of some fine selective movements on the left side and he is still troubled by the tremor on the right side when under duress."

The main problem at the time of writing is the patient's difficulty in accepting the limitations of a poor memory, visual perception problems and a loss of abstract reasoning, all of which make it impossible for him to take his matric. Emotional acceptance is particularly difficult for this patient because on a verbal scale his intelligence is only very slightly below the average.

THE PRINCIPLES OF TREATMENT

The developmental movements prepare the human infant for erect locomotion. In the same way this patient was re-educated step by step towards assuming the erect posture. He was prepared by weight bearing on the arms and by sensory training of wide arm patterns and by the development of sufficient extension in the limb to achieve grasp and release, for the fine co-ordination that is necessary for writing and other intricate movements which are demanded of the human hand.

Repetition of normal living patterns and normal timing of movements were stressed in order to improve the patient's co-ordination. He was praised only when he performed well, so that he gained a correct sensory impression of movement. Bobath facilitations of the patterns of daily living were included daily.

Not all the treatment that was given to the patient has been described in detail, but the salient points regarding problems and difficulties have been made.

In an attempt to normalise muscle tone and allow free movement the patient was facilitated first to inhibit one muscle synergy for another by means of Rood type sensory stimulation and P.N.F. and then he was encouraged to perform isolated selective movements.

Summation of sensory stimuli and the use of Reflex Inhibiting Positions were employed in order to suppress primitive spinal reflexes and the more complex patterns of Righting reactions and Balance and Equilibrium reactions were also encouraged, in order to suppress the primitive reflexes.

An attempt was made to establish control of proximal joints first, because the position of the proximal joint influences the position of the distal joints.

EVALUATION OF TECHNIQUES

An attempt will be made to assess the value of certain techniques or modalities as regards this particular patient, as it may be of value to other physiotherapists who wish to try using some of the sensory motor techniques described above.

Evaluation of Proprioceptive Neuromuscular Facilitation for this Patient

P.N.F. patterns were thought by the writer to be an effective means of:

- (a) Facilitating this patient's inhibited muscle groups, i.e. where spasm prevented an opposing muscle group from contracting voluntarily.
- (b) Improving control and strength of weak muscle groups.
- (c) Gaining joint range due to improved control and strength of weak muscle groups.
- (d) Preparing for the development of isolated selective movement, because control and strength must be present before selective movements can occur.
- (e) Improving this patient's morale, because he so much enjoyed working against resistance.

However, when he could perform all the P.N.F. patterns against resistance he still could not carry out many of the patterns of daily living without stretch resistance facilitation

and he required further sensory motor training without resistance.

Evaluation of the Bobath Treatment for this Patient

In the opinion of the writer the Bobath approach was a particularly effective means of:

- (a) Improving the patient's equilibrium reactions.
- (b) Improving the patient's balance reactions of the upper and lower limb.
- (c) Gaining the ability to carry out many of the developmental patterns that are dependent originally on the Righting reactions, e.g. rolling, getting from lying to sitting.
- (d) Gaining selective movements which were often effectively facilitated by the sensory motor approach.
- (e) Performance of the patterns of daily living without the facilitation of resistance and stretch kept the strong Associated movements minimal.

However, the patient's performance of the patterns of daily living was, in the opinion of the writer, frequently improved by having gained strength and control by the use of P.N.F.

Ice-packs and Sensory Stimulation

The results of ice-packs used on this patient were not consistent enough to gauge the success or failure accurately. However on occasions the patient showed a particularly good response to Ice-packs. It is the opinion of the writer that sensory stimulation is a very important line of thought and yields important benefits for patients. Successful facilitation is summation of sensory stimuli.

CONCLUSION

As always when considering a particular patient it is difficult to decide how much spontaneous recovery would have occurred and how fast this recovery would have occurred as the oedema of the brain subsided and the circulation re-established itself. However, it is the opinion of the qualified physiotherapists and students who saw this patient that he made a definite daily response to treatment. He did not seem to progress at all if for any reason he did not receive treatment for a period in the latter stages, and it is the writer's opinion that combining several sensory motor techniques initiated a better response than any one technique alone achieved for this patient.

It is the writer's opinion that not enough attention was paid to the prevention of contractures by static positioning in the early stages of treatment and that not enough attention was paid to mobilisation of the spine by the method described by the Bobaths in the early weeks of treatment.

The writer accepts the opinion that the use of resistance techniques increases the danger of Associated movements which may reinforce bad patterns. However, as this patient improved he required less effort to perform movements and in consequence the impulse responsible for Associated movements did not reach threshold strength. Possibly, therefore, one should weigh the risks and if one is gaining ground daily with a resistance technique and there is every hope of success, one should take precautions against Associated movements such as those mentioned in this article and continue to use the technique as was done for this patient.

The writer is of the opinion that P.N.F. cannot be applied indiscriminately for the treatment of upper motor neuron lesions and feels that it is important that the muscle tone should initially be correctly assessed. At first P.N.F. patterns should only be used for those muscle groups which are inhibited by the spasm. Later when the patient has improved and the muscle tone is more normal he can be taught to stabilise a limb and change from one synergy to another. If the patient is capable the aim should ultimately be isolated selected movements which cannot be achieved by P.N.F. alone and therefore the sensory motor training of the patterns of daily living without resistance facilitation are of great value in my opinion. Finally, one should consider the patient's physical and mental problems as an integrated whole in order to achieve the best results from treatment involving the use of combined techniques.