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Psychomotor Re-Education*

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When we consider the problem of psychomotor re-education arising in connection with the correction of pathological defects or deformities, we must have a clear comprehension, together with a correct sense of evaluation, of all the component factors involved in this subject. In the past there has been a tendency to over-estimate the kinetic factor to the detriment of the mental and neural components.

Problems to Consider

I. The analysis and correction of limps; II. The correction or improvement of joint function; III. Correction of incoordination and disturbances of balance; IV. The handling of painful cases; and V. The special problem of the paralytics. Each present factors needing special study.

Re-education is essentially the breaking up of faulty habits and their replacement by new ones which will fit the individual to meet life's situations more appropriately and efficiently. Old patterns of mental and motor response must be eradicated or modified, and new patterns established before permanent correction can become complete.

Habit is a fixed response to stimuli which may originate in the environment or from internal sources in the body or brain. Physical training begins at birth with the baby's motor responses to sensory stimuli and the reflex habits, thus initiated, are the result of (1) hereditary or instinctive forces and (2) acquired responses to environmental, somatic and cerebral stimuli.

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These overlap extensively from early life and hence we realize how intricate and far-reaching these factors are and what difficulties must be met in altering and correcting these habits later in life, when this becomes necessary. Physical defects, deformities, and disease, as well as organic inferiority and physiologic dysfunction, all influence the patterns of mental and physical response. The longer that fixed habits of thought and action, consequent to such conditions, exist, the harder becomes the problem of correction. All teachers and parents appreciate the difficulties encountered in training the average child and correcting his faulty habits. When we have added to this the lack of skill, the faulty motor habits and the mental and emotional reactions developed because of congenital or acquired handicaps, there is presented a problem far greater and less likely to be corrected without intelligent and long-continued effort. The individual behavior patterns and performance records must be studied and understood if the highest corrective results are to be obtained.

The reports of the psychologist and the psychiatrist are often of greatest usefulness to the surgeon and his technicians when mapping out their prescriptive plan as well as during the conduct of the remedial aspects of a case. Otherwise, they must proceed by trial and error methods, influenced, of course, by their own personal skill and experience which increases and accumulates with the years.

We shall not undertake to discuss the psychic aspect of the question, but we shall touch briefly upon the emotional aspects in order to refresh our memories.

The earliest emotional reactions are fear, rage, and love.

1. Fear is elicited by the following situations:
   a. Sudden removal of support.
   b. Loud sounds or excessive light.
   c. Push or shake just when falling asleep.

The physical response is a gasp, catching the breath, closing the eyelids, puckering the lips and crying. These reactions appear at birth.

2. Rage is most easily evidenced by hampering of bodily movements.

3. Love responses are elicited by stimulating of all erogenous zones i.e., by tickling, patting, rocking, etc.

A reaction pattern is a response called out by a definite stimulus of a peculiarly exciting nature. The radius of action is small; no especial adjustment is made to environment. It contains both explicit and implicit components involving all musculature, both voluntary and involuntary, as well as viscera, glands, etc.

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Instinctive-positive reactions become overlaid by organized habits as we grow to adult life. In adults, environmental influences modify the explicit features of pattern types which in the implicit are not modified and the glandular and smooth muscle reaction remains. During times of crises, normals may revert to infantile types of response usually at or near a normal level. Emotional reactions may become separated from the original stimulus which called them forth.

An emotion is an hereditary pattern reaction involving profound changes of the bodily mechanism as a whole, but particularly of the visceral and glandular systems. A pattern reaction shows details of response about the same as to constancy, sequence, and regularity to the same exciting stimulus. Adjustments from internal stimuli produce emotions, instinctive defense responses, etc. Established patterns may be broken up, modified, reinforced or depressed. Our activity level varies according as our emotional state becomes depressed or increased. There is a tendency under stress of extreme emotion for our organized habit responses to become disorganized or disappear. Organized actions are considerations of emotion plus instinct, plus habit.

The breaking down of erroneous patterns of behavior into their several parts and bringing together by patient and persistent efforts the repaired pattern, as demonstrated by more skillful performance, depends on the ability of the technician to influence the voluntary actions of the patient and to control the emotional factors involved. The technician must try to get at the bottom of the patient's mental processes; at least of those that influence his rehabilitation problem—overcoming his discouragements; capturing his attention; stimulating his interest; challenging his pride and urging his will to conquer the obstacles at hand.

According to Conkins, "The will is the mind acting as internal stimulus, inhibition or regulation; in this sense the existence and power of will is no more to be doubted than the existence of those other mental conditions which we call intellect or memory."

The ability of the technician, to influence the will or volition of patients of all ages and degrees of comprehension and to build up their interest to a point of concentrated voluntary response and cooperation is the measure of her skill.

The regulation and control of behavior or performance is more significant educationally than the training of intellect or memory. There has been more stress laid upon the factors of the motor aspect of physical ability than upon those of the sensory; and the training of the sensory mechanism

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and the improvement of sensory channels is an essential part of corrective procedure. For instance, we often note the importance of something too ordinary to pay attention to unless it is absent. When a child is semi-deaf or deaf and we attempt corrective work with him we immediately find that the lack of function in this special sense greatly increases the difficulty.

It is not simply a matter of the child not hearing spoken commands which increases the difficulty; it is as much the additional burden of further handicap; the added sensitiveness and suspiciousness which the deaf are likely to have.

Gradually there develops a compensatory acuity of other parts of the sensory mechanism, but in children these new channels of training are not in full use. This was illustrated not long ago in our own clinic in a case of faulty posture. The technicians had worked a long time, several months in fact, and were about to give up in despair. Feeling certain the child was feeble minded they sent her to the psychologist who discovered that she was partially deaf, which accounted for her dullness and the fact that she received only a blurred impression of what the teachers were saying. The strain of trying to guess at what was said made the child nervous and kept up a certain fatiguing stress that only added a further burden to her other handicap.

Still greater difficulties are observed in cases of blindness or semi-sightedness. We very frequently find, in connection with the cases of spastic paralysis of incoordination, an involvement of the eyes with varying degrees of faulty vision and strabismus.

As the visual sense is important in the orientation of the body in relation to the environment, any deficiency in it requires added stress in accomplishing balance and skill development. The patient cannot get a clear image from the mirror, cannot see the demonstrations of the technician, does not clearly define objects to be reached or grasped or marks on the floor, consequently the field of impressions being restricted, performance of expression is hampered.

Tactile sense may also be disturbed, particularly in some of the nervous system diseases as the ataxias, scleroses, etc. Many, also, of the other incoordination cases have defective joint sense which disturbs their sense of equilibrium.

There may also be defects or deficiencies in the sensory mechanism with which we gain information as to the environment, information which must be registered or correlated so as to influence the motor acts required in meeting a given situation.

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All the senses supply information for this projection sense which helps us to control the position of the body and its parts in relation to things and conditions around us.

The development of skill depends greatly on this ability; judgment of the speed of an approaching ball is required for proper junction of the player with the ball. In throwing to a player, running, estimate of distance, judgment of wind resistance, weight of ball, must be instantaneously computed and correlated before the coordinated action of hands, arms, body and eyes can execute the throw or pass. The aim, the force, the height, and the distance must all be registered before the proper adjustment of muscle action occurs which will give an appropriate performance.

Playing golf gives an excellent example of this coordination. Taking into consideration the distance for the ball to travel; the direction, angle and force of the wind; the topography of the ground; direction of slant; hazards, etc; the direction of aim, character and force of stroke must all be coordinated.

All movements and games of skill as well as all occupational skills require the training and education of this portion of the sensorium, and the reflex habits of movement are good, bad or indifferent in direct relation to such training.

If then a technician, teacher or parent attempts to exact the performance of acts by a patient without regard to the state of his sensory abilities, there is likely to be a willing effort but a very tangled and poor result. Consequently the *sequence* of required movements should be graded in accordance with sensory capacity.

Parents of physically and mentally defective children are very prone to force and encourage them to do things far in advance of their ability in order to cover the deficiency, and they also are stimulated to do this by their own sense of humiliation and sensitiveness because of having such a child.

Analysis and Correction of Limps

Disturbances and disorders of locomotion may be due to malfunction of muscular, neural or skeletal systems.

Diseases or injuries of bones or joints (particularly the latter) of the lower extremeties usually directly affect the gait because of pain, malalignment, absent or limited action in one or more joints.

Muscular faults are due to paralysis or paresis, pain producing spasm and unbalance of joint action, or to scars and contractures, limiting muscle action and joint range.

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Neural causes are noted in diseases of the brain and cord which produce over-action with hypotonicity and complete paralysis or disturbances, either peripheral or central, in the correlating and coordinating mechanism.

The disturbance may be either sensory or motor or both, either above or below, producing incoordination and lack of balance with jerky and uncontrollable movements and consequently faults of locomotion. The analysis then of locomotor faults will show the above conditions, and the outline of treatment will depend largely upon the primary causative difficulty.

There are two chief factors in all limps; first, the mechanical or actual causative factor; second, the habitual pattern of movement.

The principal skeletal conditions producing limps, are: a. growth defects or deviations; b. injuries; c. disease.

(a) Developmental divergences may occur any time during the period of active skeletal growth from the prenatal period to past adolescent life.

The prenatal produce the so-called congenital defects, the most common of which are club-foot, congenital dislocation of hips, and failure of development of a lower extremity or one of its component parts, such as the hemiectromelia cases in which there is abnormal shortening of one leg from lack of development of parts of the tibia or femur.

Under developmental divergences we must also consider congenital luxation of the knee joint, abnormalities of growth of some of the foot bones, or embryological faults in development of some of the joints of the leg and foot as in the rarer arthrogryposis multiplex congenita, with contracture and accompanying club feet. (Stearns).

Epiphyseal anomalies and disturbances during the early growing years may produce a variety of deviations which disturb alignment of the legs and feet to an extent sufficient to produce limp. For instance, absence or retardation of growth of tibial epiphyses may allow the more rapidly growing fibula to push the foot into a club foot position resulting in an interference with normal gait.

Severe grades of skeletal enfeeblement, as pointed out by Jansen as producing coxa plana, coxa vara, longleg, knock-knee, flat foot, etc., may produce early or late modifications of gait, especially if asymetrical in character.*

(b) Trauma is one of the commonest causes of limps and occurs at any age. Fractures and dislocations during labor, unless promptly recognized and treated, may give rise to non-union or mal-union and, later, growth disturbance and deformity. The same situation exists during the re-

*_Enfeeblement of Growth_, Mark Jansen, Leyden, Holland.

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mainder of life from the accidents which may occur on the road, in the field, in a factory, etc.

Without elaborating at length, the sequelae which are chiefly causative of gait faults are:

1. Toe drop from the injury, directly, or from failure of maintenance of the foot at right angles during treatment of leg injuries.
2. Partial or total ankylosis of one or more joints of foot or leg.
3. Deformity from malalignment at fracture site or at the joint.

Soft tissue injuries with loss of muscle or tendon function from scar tissue contraction, spasm, pain and muscle contraction.

(c) The principal pathological causes are such diseases of bones and joints as rickets, tuberculosis, osteomylitis, various epiphyseal inflammations like Perthe's, Schlatter's, Osgood's and Kohler's diseases, and syphilis, with occasionally the rarer conditions such as fragilitas ossium with its series of fractures usually healed in malposition, fibro-cystic disease, and tumors which require serious surgery—occasionally amputation.

Correction or improvement of joint function probably occupies as much of the time and attention of the surgeon as any portion of his work. Joint function is disturbed in several ways:

a. Deformation from growth defects.
b. Trauma involving any or all the joint components.
c. Disease, injury, or deficiency in the muscles controlling the joint.
d. Disease involving any or all the joint components.

This, in general terms, must be considered the skeletal factor and the muscular factor.

The free mechanical movement of the joint may be wholly absent as in an ankylosed condition which may be bony or fibrous, and, if of the latter type, it may be total or partial. Destruction of the cartilage with the formation of adhesions accounts for such a condition as fibrous ankylosis. Bony changes do not necessarily take place, although it is usually found that a moderate ankylosis with only a few degrees of range is likely to be painful and therefore a long ankylosis is to be preferred. There is no sorrier sight than that of a person with a few degrees of questionable motion going around to untrained or poorly trained technicians, being kept under long and often painful treatment at the hands of ignorant quacks or unscrupulous doctors, with heavy loss of time and expense, when the probability of adequate restoration is remote. X-Ray study and examination usually show whether long ankylosis should be treated by operation, or an attempt at surgical restoration by orthoplastic procedures, should be resorted to.

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The technician can readily tell what the outlook is after a few weeks of treatment provided progress of range of movement is measured and record of pain or spasm is kept. When neither active or passive movement produces increase of range after two weeks, either with or without pain, the case should be referred back to the surgeon with the record. He must ascertain by clinical examination and X-Ray study whether or not there exists a bony blocking of movement or whether adhesions only are to blame. If the latter is the case, and the adhesions seem to be not too old or hard, he may resort to manipulation under anaesthesia at which time, if he is wise, he will make only one attempt to forcibly tear up the adhesions in each direction of normal motion, and if the condition is of long standing, only to a small extent— say 10 to 20 degrees. He will then return the case to the technician who must give sedative treatments followed by one or two efforts—active-passive, never passive only—to obtain the amount of movement gained by the manipulation. After this attempt, the part should be elevated and a sedative stripping or effleurage form of massage given. Daily treatments are preferred and needed to hold the gain. If the surgeon can gain but a few degrees and his technician has difficulty in retaining it, or if, due to pain and spasm, the patient loses it, the chances are against saving the joint function and other surgical considerations must be given. If, however, some gain is made and there is only a rubbery resistance at the extreme of the arc of motion, a second or third manipulation, properly spaced in time, can be done. Each time the best of judgment must be used or else the condition will become worse and all motion may be lost. If at any time after a few weeks, the progress comes to a dead stop, it is likely that the point of mechanical blocking has been reached and, if so, further attempts should be stopped, as harm will be done and a traumatic arthritis will be set up.

Acute traumatism involving joints, such as strains, sprains, dislocations, acute synovitis, etc., need ice bags and pressure bandages immediately with splints for the more serious occurrences. After a few days to a week of rest, cautious baking and massage may be started, but only a short baking, and very careful light petrissage, stripping or effleurage over the painful spots, followed by a few active-passive movements of small range, increased each time within the painless arc, however.

In other types of arthritis, of an actue form, fixation and rest are used at first, and then, as above, they will be turned over to the technician for reduction of oedema, lessening of pain and spasm. Increase of motion, must be gradually brought about, as stated above.

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The most significant psycho-physiological facts to remember are: first, the part must be handled gently but firmly, making all movement with assurity. If you are halting and timid, or bungling and awkward, you at once give the patient the impression that you are new at the game or unskilled, and he will not have confidence in your ability.

Confidence of the patient is absolutely essential to obtain because, otherwise, you cannot stimulate him to the point of actively forcing movement in the face of anticipated pain or spasm. He will be uncertain and afraid that you don't understand the case, and if he has pain he will think you have caused it, and you will not be able to overcome his fear and inhibiting spasms.

When patients do have assurance that they will not be taken unawares and that you will not force the joint when off guard, you can make proper progress. The practice of forcing motion and breaking adhesions by sudden manipulation is to be condemned except perhaps in occasional special instances, and then the surgeon himself should do it and explain the matter to the patient beforehand.

When the patient is made to understand that it is his active stimulation of certain muscles that automatically relaxes the spasm of the opponent group, and that the technician will only help to the extent of taking up the last degree or so of movement which he cannot himself gain, a few degrees of advancement should be made at each treatment.

In chronic cases of long standing, either of the arthritic pathological type or in injury cases, there is added to the above condition a mental phase which can be most trying and discouraging. The mental scars of an injury a year or more old may be still smarting, with legal action perhaps still to come. These patients are extremely sensitive to both internal and external stimuli, and reactions out of all proportion to the actual amount of pathology may exist. Not many are real malingerers and the pain they suffer is real enough, but they cannot close the sensory door against it. In consequence anything that will upset their mental equilibrium will result in painful sensations referred to the affected joints.

The technician must learn to handle such a situation as she would a child when it falls and gets hurt. She must transfer the attention to something else or open up another door to the sensorium which automatically closes the other doors for a time, and thus the hurt may be crowded out and not register much. This handling of the sensory mechanism is similar to creating a draft by opening a closed door which closes another that may be open.

The technician should become clever in substituting interest or actions

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which draw the patient's attention away from the affected part or, in lay language, which "keeps his mind off of it." By handling or massaging some other than the affected or painful area while engaging the patient in conversation wholly foreign to the matter in hand one may at a proper time gradually progress nearer to it, and in fact by making the movements so unobstrusive and so regular as to be monotonous, a much faster progress is made, and the door may be kept closed for that region.

It is best for almost all treatments to have the patient lie down and not be able to see the part while it is being worked upon. When it comes to the actual making of active motion however, he should see the part, or, rather, have a goal or marker arranged so that his attention may be centered, and held so hard to the point of breaking the record that the inhibiting spasm may be kept in abeyance, and pain not be allowed to register. Whenever the previous mark can be reasonably passed without producing pain, one should not continue to the point which produces pain. Keep the patient's mind occupied with the accomplishment and what is to be expected for next time, and enthusiastic with the idea of progress—keep pain out of the picture as much as possible.

After the correction of the bone or joint conditions by surgical or non-surgical treatment, or both and, when the surgeon is ready to institute the beginning of walking efforts, the technician will be faced by the problem of analysis and correction of gait faults.

She will first consider the above mentioned conditions and start corrective procedures. She must ascertain how much hold-over of previous habit there has been, how much apprehension or fear exists, and how much is due to the necessary alteration of the mechanics of locomotion.

An effort must be made to break up old habits resulting from former established pattern of movement, as well as to overcome or offset the fear of pain or falling, before actual progress can be made. It must be recognized that a residual mechanical fault exists due to muscular or joint involvement and that some limp will remain. The problem will then be to obtain the best possible gait under the circumstances.

Walking is a highly coordinated action of many muscles involving the balancing mechanism and depending as well upon joint integrity. The most effective means of breaking up old habit patterns and of preventing the acquirement of new faulty ones is the breaking down of the whole action of walking into its component parts.

Exercises of different kinds should be given to develop the control of each segment. For example: first, hip joint movements in all planes with

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especial attention to those weaker muscles that need special development; then knee joint, and lastly, foot and ankle; gradually hip and knee together, then knee and foot, then all three together, first in lying position than standing holding to a support. If a crutch or brace or both are necessary, movements of hip joint forward and backward, and sidewise should be executed a few times before actual steps are taken.

When each segment is under fair control, their combined use gives a result far better than where the complex act of walking is tried at once and afterwards an effort is made to improve its execution.

After the patient has begun to be fairly steady in balance and the actual mechanics of gait have become obvious so that the residual limp can be appreciated, progress to the final stage may be accomplished.

The last stage is an attempt to cover up the actual residual limp by teaching the patient some mannerism which will take attention away from the actual defect. A swing of the arms and shoulders—a slight swagger or roll—can be obtained with a certain rhythm of action which is highly deceptive.

A word of caution in relation to a bad habit that is often overlooked is, the tendency for paralytics, especially children, to swing between their crutches in order to make speed or distance. That will develop strong shoulders and arms but not legs and hips, so it is wise to be strict with them and insist on single steps, to true walking gait in order to force the development of the locomotive apparatus.

The Correction of Incoordination and Disturbances of Balance

By incoordination we mean the inability of an individual to control and execute properly a series of movements needed to perform motor acts necessary to the normal functioning of the body as a whole, or the related activity of any of its parts. Maintaining the whole body or any of its parts or segments in static equilibrium, while not usually considered in connection with movement, is essentially a motor function requiring the highest degree of coordinated action. In fact there is a static factor which is constant and continuous during all our waking hours because the body as a whole must be maintained in certain fixed positions in order that there may be a foundation from which the various moving parts may act. All movements of skill require the development of this control of the mobile and nonmobile parts in a precise and definite way. When the development of skills of various kinds is referred to in physical education we mean the perfection of these coordinated movements by practice and repetition to the point

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where the grace, form and precision of action of all the working parts involved becomes easy of execution and practically a reflex habit.

The four physical constituents necessary to the development of coordinated movements are skeletal, muscular, neural and mental—that is joints must be movable, muscles controlling them normally responsive, neural tracts for conduction of impulses open, and brain centers for reception and control of incoming and outgoing messages intact.

Pathological or functional disturbances of any of these four may upset the balanced coordination of movement or prevent their development, if the pathological process becomes operative before the age when skilled movements develop, for example, congenital, post natal, or early childhood. We have already discussed the skeletal and muscular factors more or less, and technicians have more knowledge of these factors so we will consider the neural and mental further.

The re-educational possibilities in any given case vary greatly from the following causes:

A. The mental status of the individual.
B. Age of patient.
C. Length of time condition has existed.
D. Whether cause is functional or pathological.
E. Whether or not local or constitutional.

A. As re-education is essentially mental in character the response to training is determined to a great extent by the intellectual status of the patient. In comparing given cases we find that the higher the I.Q. the better the possibilities, especially over the dull normal, moron or feeble-minded, other conditions being equal. For instance a feeble-minded child with a faulty stance or gait with only a slight or moderate mechanical defect might be improved in that respect more than a super-normal one whose mechanical or pathological fault was greater.

A clear comprehension of orders, suggestions and explanations coupled with good powers of volition are essential. A good memory plus concentration or controlled attention are also qualifications equally valuable when they exist, although all three may be extremely variable even when the intelligence rating is high.

Technicians must not jump to conclusions too quickly in estimating the mental status, for many a child, especially the spastics, may seem to be mentally deficient when in reality they are only mentally handicapped or retarded. It is always desirable to have a psychologist's report or at least the impressions of the doctor and school teacher, when possible, to aid their

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own ability to judge. Small children who cannot even speak and who seem seriously retarded may have such a gleam of intelligence in their eyes that one is encouraged to believe their mentality is good but locked up.

The problem becomes one of finding the key. What avenues of sensory approach will obtain motor expression or modify existing motor activity? Once these channels are opened it is often surprising to see what progress can be made.

It is commonly noted that desired movements may be elicited—and controlled—when accompanying music or the rhythmic beat of a metronome, or the sound of song or rhyme.

Even the subnormal mentally will respond to music and appear to recognize or to be influenced by the rhythmic effect even when they cannot understand what is said to them. Probably there exists some racially old mechanism which has evolved from the day of the tom tom and is a memory which can be stimulated and which seeks response through motor avenues.

B. In considering the age of the patient one must appreciate that there are various ages and that they may not be reconciled or normal in relation to each other. The chronological age in years and months must be known but only to be able to compare the child's motor responses and his sensory reception to an average used as a standard.

The basal age should likewise be known when possible to help in estimating what to expect from training. It is well known that there is a very definite relationship existing between these two ages. Re-educational efforts must be made to bring these two as near to their proper relationship as possible.

Physiological age also should be determined for certain forms of activity must be predicated upon whether this age compares properly with the chronological and mental ages.

For instance an overweight, fat child of five who may appear dull normal, with slow time reaction, sluggish movements, with awkward performance and poor coordination may turn out to be physiologically retarded and inadequate. An X-Ray study of the development of ossification of the skeleton by noting the number of bones in the wrist (known as the carpal index) will probably show a retardation of ossification, his growth history may show bottle feeding and faulty diet with delayed dentition, late walking and talking.

This would indicate or at least suggest probable endocrine dysfunction and would explain both faulty body chemistry and skeletal faults resulting from the discrepancy between these ages. A five-year-old child with a four-

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year-old skeleton, with motor responses perhaps of a three-year-old may perhaps be attempting to imitate the activities of five, six or seven-year-old playmates. Is it any wonder that such a child should be developing such skeletal faults as pronated ankles or knock-knee, if not coxa vara and rounded back, together with the retardation of development in the motor and mental sense?

C. The duration of the handicap has also a bearing upon the re-education possibilities, in any case. If it has existed from infancy, with no previous patterns of normal motor performance built up, it is, of course, more difficult to obtain normal physical function. Also, never having been mentally conscious of what normal movements of an affected part should feel like, much patience and effort are required to achieve the various co-ordinated movements necessary to good function even after previously existing deformities may have been corrected by surgery.

If motor function is upset by disease or injury after five or six years of age, there will still remain a certain memory of the normal and a pattern of movements which can be recultivated even after several years have intervened. In some instances, even after a great many years, providing the neuro-muscular channels are still open to conduct impulses, motions and balance may be obtained after correction by surgery of bone defects or disturbances.

A good example of this occurrence is seen in many cases of long-standing deformities such as a stiff knee or hip in bad position after the operations necessary to straighten out the leg, and perhaps following the making of a new false joint. Although much atrophy and almost a semi-paresis may exist, cautious efforts at movement may result in re-establishment of fairly good function because the nerve tracts are still intact.

So it is not always length of the time *per se* that acts to interfere with return of function, but rather the relation of the time element to the nature of the condition causing the handicap.

If the cause is pathological, of course the longer the period of disease the more difficult and longer will be any period of retraining, and the less favorable the prognosis for normal function.

D. This question of pathological or functional causation has a bearing because many a condition of nervous type, like tics and spasms, or the various handicapping manifestations of true hysteria, may be considered strictly non-pathological but may present greater difficulties of correction than a lesion such as tuberculosis of joints or of paralytic causation.

E. The difficulty is also dependent somewhat on whether or not the

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condition is an affection of one part only, or is of a systemic or constitutional nature. The locality has much to do with the prognosis because of the difference of function of different parts.

For instance a localized injury, deformity or paralytic involvement of a hand or arm even of nominal severity might cause a much greater degree of dysfunction than a similar condition in a leg or foot for it is well known that the more highly coordinated and intricate a mechanism is the more difficult its re-education becomes. It is possible to retrain a foot and leg to be reasonably good as a support even though locomotion is not perfect and its range and variety of movements and functions is limited, whereas the great range of movement of the arm and the variety of positions that are possible for the use of the hand, which is a complicated tool, makes any handicap a much more serious obstacle to restoration through re-educational and surgical means.

Constitutional diseases which have special manifestations in bones, joints or muscles such as arthritis, locomotor ataxia, dystrophies, spastic paralysis, etc., may all present a variety of handicap in which not only the parts involved must be worked with but also the mental state or morale of the patient becomes a problem affecting the prognosis very definitely.

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