THE TREATMENT OF TABETIC ATAXIA.

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IN a short paper which appeared in the *BRITISH MEDICAL JOURNAL* of August 26th, 1911, I demonstrated clinically the beneficial effects I had obtained in tabes dorsalis, even when marked ataxia had occurred, from systematic practice of the exercises designed by Frenkel of Heiden for restoring the power of co-ordinate movement.

Since then I have received many inquiries respecting the treatment and also on points not included in my former communication. It is gratifying to find so much interest evinced in this successful method, offered by the Frenkel system, of mitigating the unhappy condition of patients suffering from this disabling affection. Yet the correspondence also shows that there still exists a good deal of misapprehension regarding the nature and practical application of the exercises, as well as the training through which the patient must go to produce the results desired. It is to these considerations that I propose more particularly to address myself on the present occasion.

It may be stated at once that the Frenkel system does not consist of a series of gymnastic exercises which the patient can be set to perform each day from a list supplied to him with directions for doing them. It consists of a series of definitely directed movements made in different positions of the body with specific objects in view, under the immediate direction of a physician, who must, of course, have made himself acquainted with the aim and object of each movement used, a knowledge which can only be gained by careful study and reflection.

The degrees and forms of ataxia met with in different patients suffering from tabes being very diverse, the physician has, after first carefully determining the precise nature and extent of the disturbances present, to choose the most suitable exercises and adapt their sequence as well as their duration and intensity to the individual requirements of the case.

The most serious dismemberment of the ataxic patient being usually the loss to a greater or less extent of co-ordinative power in the lower extremities, the greater number of the exercises are designed for the purpose of enabling him to regain control over these various movements. Others of a different kind are intended to restore lost power over the movements of the trunk and upper extremities.

The exercises designed for restoring control over movements of the lower extremities comprise: (a) Those which are practised in a recumbent position while the influence of gravitation and the necessity of maintaining the equilibrium of the body are in abeyance; (b) those practised in the erect posture, consisting of walking exercises of various kinds; (c) those which combine various movements and evolutions carried on during walking, such as turning, sitting down, etc.; and (d) those which are done in the sitting position. The most numerous of these exercises are those of the first class, of which there are ninety-four, while of the walking movements there are twenty-eight. The physician is, therefore, well provided with an ample series from which to make a selection suitable for the patient.

The exercises taken while the patient rests in bed or on a couch consist of those practised without apparatus, which are far the most important, and those in which apparatus is used. The former are subdivided into six groups, each of which has for its aim a certain definite object. Thus the first is devoted to the practice of general movements of the limbs, and consists of flexion, extension, adduction, and abduction, the heel resting on the bed during their performance in order to economize muscular force as much as possible, the range of movement in these exercises being considerable. In the second group the limb exercised is raised from off the bed while flexion and extension movements are performed, and the patient is practised in touching definite portions of the resting limb with the heel of the limb being exercised. In these exercises we have a combination of balancing the quasi-suspended limb and the performance of movements at the joints. This series leads to another group designed to develop a maximum degree of co-ordination with a

minimum of muscular contraction. A large group of exercises are arranged to teach the patient to perform, first, similar and, secondly, dissimilar movements at the same time with both limbs. Finally, there are exercises involving high degrees of co-ordination which are rendered more and more difficult by reducing the amplitudes of the movements.

During the practice of these exercises the patient follows closely the movements of his limbs with his eyes. As soon, however, as he has learnt to control his movements somewhat it is of considerable importance to practise him in doing some of the exercises with his eyes closed in order to develop sensory control.

If the ataxia be very great, co-ordinative exercises are useless at first, and one has to be content with practising simple contractile movements of single muscles or groups of muscles having similar functions, limiting the movements to a single joint, as the toes, foot, leg, and thigh.

The exercises practised in bed with apparatus are of less importance than those previously mentioned, but are often useful for home practice, the apparatus, which is very simple, taking the place of the physician's hand in focussing the movements of the limbs.

It must ever be remembered that to the tabetic patient all exercises are very tiring, owing to much energy being uselessly expended in attempts at co-ordination; they are also a considerable strain on the attention. It is therefore imperative that they be practised only for a few minutes at a time, and frequent rests taken during the practice hour. For these reasons it is most advantageous for the physician to instruct two or three patients alternately, so that the first, having done a short turn, may rest till each of the others has had his spell, after which the first begins again. In this way even four patients may receive in successive turns as much practice in one hour as is desirable for them to have at a single sitting. It is usually found convenient to practise exercises in the recumbent position during the forenoon, leaving the afternoon free for practising exercises in the erect posture when the degree of ataxia permits.

Appliances Required for Exercises in the Erect Posture.

Exercises in the erect posture should be practised in a room or corridor of sufficient length to render it unnecessary for the patient to have to turn round frequently—which is difficult for the tabetic to do—and of sufficient width to permit the patient with an attendant on either side of him to move freely. The exercise track which I have constructed at Eversley Sanatorium is about 60 ft. long by 7 ft. wide. Along it at intervals are placed chairs for the patients to rest whenever fatigued.

On the floor is a strip of linoleum a yard wide, on which is painted a plain black stripe 21 cm. wide. Along one side of this is another narrower stripe 11 cm. broad, and beyond it are two other stripes also 21 and 11 cm. wide respectively, on which are painted in white transverse lines at fixed distances, thus dividing these two long stripes into sections which represent full steps, three-quarter, half, and quarter steps. The full step is 63 cm. long, the three-quarter step 45.5 cm., the half step 30.5 cm., and the quarter step 15 cm. These two cross-barred stripes present the appearance of a ladder depicted on a flat surface.

On a second piece of linoleum are drawn in duplicate eight pairs of footprints, those of the one row being figured in the reverse direction to those of the other row. The distance between the heel outline of the one footprint and that of the next is 35 cm.; each pair of footprints shows the feet at an angle of about 40 degrees. The width of each row is 31 cm.

Down the centre of a third and wider piece of linoleum are outlined, in pairs, the anterior portion of the foot at distances of quarter steps from one another, and from the central pair a series of curved lines at distances of quarter steps from one another are drawn on either side; the whole arrangement of the diagram is in the form of a Geneva cross. It is used for the purpose of instructing patients in taking steps in different directions at word of command.

On a fourth piece of linoleum is depicted the outlines of footprints in four different directions having a common centre for the heel. This diagram is used to instruct the patient how to turn by the right or the left.

A stair consisting of four steps having each a rise of 12 cm. and a tread of 35 cm. On one side is a strong handrail.

A strong chair on which the patient can practise systematically sitting down and rising up completes the necessary appliances.

Method of Instruction.

Before attempting to supervise the instruction of a patient in these exercises the physician must make himself acquainted with the mechanism of the normal movements

of the human body as a whole, and of its several parts, also of the sequence of events involved in each given movement. He must likewise acquaint himself with the deviations from the normal exhibited by the tabetic patient in his attempts to effect definite movements. The combination of movements which occur, for example, in locomotion, having been acquired in childhood, are so automatically performed by us in after-years, that we are not conscious of the various movements our bodies go through when we take a step, or when we do the apparently simple act of sitting down on a chair. Yet each of these are complicated acts involving several regular sequential movements of the trunk and lower limbs which the tabetic patient has to learn afresh to enable him to perform them properly. Thoroughness in teaching and in learning the details of the movements made in the various acts we do in everyday life is essential when impressions have to be made upon and accumulated by fresh neurones unaffected by the disease, and faulty methods of movement acquired during the course of the disease have to be eradicated.

The first track on which the patient is practised in walking exercises, after he has been well grounded in the method of taking a step, is the plain broad stripe. Little heed is given to the length of step in the first instance, but attention is concentrated upon the method of taking it. If the ataxia is only moderately severe one attendant may be sufficient, but he must always be at the patient's side though not touching him, ready to give him support, if required, by catching him under the arm, as tabetic patients are very liable to fall or twist an ankle suddenly and without any previous warning. Such an accident, even if the patient be not hurt, is very disconcerting, increases his feeling of insecurity and makes him nervous, so that he cannot concentrate his attention on the exercise he is doing. The attendant's duty is, therefore, to carefully and closely watch the patient, while that of the physician is to instruct him in the exercise and correct the faults he makes.

The clothes worn by the patient should be light, and he can well dispense with a coat, as the exertion of taking only a few steps usually makes him feel hot. He should wear strong laced boots, with broad non-slipping rubber or felt soles, to support his ankles and give him stability.

The patient should practise walking exercises only for a few minutes at a time owing to the fatigue both of body and mind which rapidly supervenes, and should stop on the occurrence of the first signs of fatigue. The best indication of this is increased action of the heart. His pulse should therefore be taken at frequent intervals to see that it is not unduly rapid (not over 120 to 130 per minute), and, if it is, he should rest on a chair till it is again normal before resuming the exercises. While he is resting another patient is put through a turn; a third, and even a fourth, may with advantage be thus exercised alternately, as this has the salutary effect of stimulating their endeavours to vie with one another in doing the exercises well, and so leads to progress. At the beginning the work is uphill, and little progress seems to be made for awhile; but, with persistent practice and careful attention on the part of both physician and patient, improvement will in due course be noticeable. The tabetic patient has a marked tendency to take his steps too quickly, to stamp his foot down forcibly, and to rotate his leg and foot outwards; these are faults which have to be carefully corrected. He must be taught to keep his eyes fixed closely on the movements of his feet and legs, till he gains a certain amount of control over them.

The next stage of instruction is to teach the patient to take steps of definite length. For this purpose the broad stripe on the floorcloth divided into steps, half-steps, and quarter-steps is used. The patient should always begin with half-steps, these being the easiest for him. They are practised in a forward direction and to the side; the latter is the simpler movement. The former is practised first by stepping out with one foot and bringing the other up to it—single step; secondly, by swinging the second foot forward beyond the first—progression steps. Quarter-steps are next practised, then three-quarter steps, and finally full steps, which are the most difficult. Having acquired a certain degree of proficiency in taking these various steps, the patient is then ready to practise steps of dif-

ferent lengths or mixed steps, changing from about half to quarter, three-quarter, or full steps at the direction of the physician. He is also practised in taking single steps backwards and in taking steps forwards while his eyes are directed to some object in front of him, and with his arms in various positions, so that he is unable to observe the position of his feet and their movements.

The paired footprints represented on the second and third pieces of linoleum are used especially for patients in the early stages of the disease, when only slight ataxia is present, likewise at the end of a course of treatment, to teach precision of action and taking steps in different directions voluntarily or at word of command, the patient being required to put his foot down exactly and accurately on the points indicated. To use them he requires to be able to maintain his equilibrium well, to balance himself on one leg, and to move his limbs definitely at will.

In the movements of every-day life changing direction—in other words, the act of turning—sitting down, and rising from a chair, and ascending and descending stairs, are very important. It would occupy too much space here to describe the various stages we unconsciously go through in doing these simple acts and the difficulties the tabetic patient encounters in attempting them, consequent upon his loss of power of co-ordinating the actions of the various muscles and groups of muscles concerned in them. Thorough instruction and practice in all the details of the movements should never be omitted. The fourth diagram, the short flight of stairs, and a chair, are, therefore, important equipments for the Frenkel treatment. The patient should be taught these movements concurrently with the walking exercises as early in the course as possible.

After considerable progress has been made in walking on the broad stripe, the still more difficult task of doing walking exercises on the narrow stripe, which is about the same width as the sole of the patient's boots, is begun; also standing and walking exercises with bent knees. A variety of exercises in walking is practised by patients in groups of three or four together for the purpose of teaching them to time the movements of their limbs, which is a matter of considerable importance when walking in frequented places.

Exercises in the sitting position are chiefly used conjointly with those practised in bed in cases where the loss of co-ordination is considerable. They are chiefly directed towards teaching the patient such actions as raising the thigh with the knee flexed, and putting the foot down on a footprint drawn on the floor so that the whole of the sole shall touch the ground. Movements of adduction are also practised in this position to correct the outward throw of the knees so common in ataxic cases.

An important question in regard to the Frenkel treatment is, When should it be begun? The answer is undoubtedly on the earliest manifestations of symptoms of ataxia occurring. At this time the loss of articular muscular and cutaneous sensibility is comparatively slight; hence the chance of regaining the maximum co-ordinative power over movements of the limbs is greatest. The greater the loss of sensation, the longer and more difficult will be the treatment. But so long as some sensibility remains in the limbs improvement may confidently be looked for from the treatment. Even in advanced cases unexpectedly good results may often be obtained. The more experience I have of the treatment, the more convinced I am of its beneficial effects in the great majority of cases. The hopes it offers to the patient of regaining much of the co-ordinative power he has lost and of thus improving his condition should certainly be pointed out to him by his medical attendant.

The duration of the treatment depends not only on the degree of ataxia present, but also on the natural aptitude of the patient and the determination with which he sets himself to his cure. The longer the exercises are continued, the more certain and lasting is the improvement produced. It is unfortunate for many that the treatment cannot be carried out at home or in conjunction with the patient's ordinary avocation in life, since it requires his undivided attention for a certain time, at least till some progress has been made. This inconvenience might be reduced somewhat and much benefit derived if persons suffering from this affection were to devote their holidays to the treatment.