

Primate Reflexes and other Factors in the Rehabilitation of the Hand

Lt.-Col. J. K. McCONNEL, D.S.O., M.B.E., M.C., M.C.S.P.

IN recent years the value of sensory influences and evolutionary factors, for example the amphibian reflexes as described by Temple Fay, have been used to further rehabilitation. However, reflexes in which visual influences play an essential part have not been fully exploited. These may be classed as primate reflexes because our remote ancestors developed them in the trees and after they left the forest.

In *Essays on the Evolution of Man*, Elliot Smith shows that the development of the primate brain was associated with that of the interaction between the eyes and hands. This was re-emphasised by Le Gros Clark in *Antecedents of Man*, in which he argues that our ancestors, as distinct from modern apes who make little use of their thumbs, having visually selected their landing site on a slender bough, made contact with the branch with widely abducted thumbs. The resulting lever-like action on the thumbs caused 'stretch' of the intrinsic muscles which produced a grasp reaction. Fossil evidence of well-developed thumbs and intrinsic muscles in the man-apes of South and East Africa, has been described (John Napier's observations, reported by Le Gros Clark in *Man-Apes or Ape-Men*). The intricate eye/hand interactions involved in primate grooming were considered by Dr. John Napier to be a prelude to early man's handling of tools. He pointed out that the particles which they removed from each other's fur were stationary, not moving parasites.

It must also be remembered that normal voluntary movements are to a large extent supported by muscular activity controlled below consciousness level. The sequences of reflex actions are modulated by visual, tactile, and kinaesthetic feedback.

Of the four exercises described, the first three are basic exercises which are useful because they improve the drainage and blood-flow in a hand which is painful. They automatically encourage co-ordination and flexibility of the hand. The patient is encouraged to note the various sensations which trigger normal hand movement. In the fourth exercise, the patient's voluntary actions produce visual, tactile, and proprioceptive stimuli which control the grasp of the hand on a slender hand-hold.

When using the exercises the following points should be borne in mind.

1. The working conditions are chosen to suit a variety of patients.

2. When a hand has been damaged, recovery of the activity of the intrinsic muscles tends to lag behind that of the long muscles in the arm, if the latter have

avoided damage. These exercises help to restore muscle balance.

3. A large proportion of the normal muscular activity of the hand was under automatic control, when the patient was engaged in everyday activities or hand-skills; consequently, as soon as movements of the hand are permitted, it saves time and effort if these components are recovered subconsciously, as described in these exercises.

4. A set of reflexes which are likely to be missing during rehabilitation are primate reflexes, triggered partly by visual feedback and partly by stretch of the muscles concerned. Hence, the patient must use his eyes during these exercises.

5. Exercises (assuming an injured right hand):

1. The sitting patient places his hands one on top of the other in front of his body. Both hands are palm down with the right hand uppermost. The right thumb is lodged between the thumb and index finger of the left hand, giving it a safe anchorage. Watching the fingers of his right hand carefully, the patient slides them in all directions over the dorsum of the left hand. The aim is to maintain an even touch by the right fingers over the irregular surface of the left hand.

2. This exercise is the same as exercise 1, except that the left hand is held palm up and the pad of the right thumb is lodged against the 5th metacarpal joint of the left hand. The patient can then perform exercises 1 and 2 with the fingers of the right hand moving fractionally above the surface of the left hand. With the eyes open our legacy from the eye/hand associations which occurred during our ancestors' grooming permits visual and kinaesthetic control. With the eyes closed the patient is relying on memories of these sensory influences.

3. *Using feedback from a less-sensitive skin surface:* the patient sits comfortably, his left hand holding the right thumb against the upper surface of his right thigh, which may or may not be covered. He moves the fingers of the right hand in an irregular manner over the outside of his thigh, noting the varying sensations and the co-ordination and flexibility of the right hand.

4. *Hand-towards-thumb Reflex.*

The following are required:

- (a) a hand-hold which is seen to be graspable;
- (b) a lever-like action of the thumb.

The patient sits comfortably and raises his left arm to waist or shoulder level with his elbow flexed. He

He agreed in Correspondence

When the fingers are straightened during these exercises intrinsic muscle action is encouraged

selects a point on his left forearm, so that when the pad of his right thumb is on this point the palm and fingers can partly encircle this hand-hold. The right thumb is drawn back near to the right shoulder and, focusing his eyes on the selected point, the patient aims the pad of his right thumb at the point. The wrist should be dorsiflexed. The thumb should be widely abducted, and the fingers outstretched. The right hand is carried forward, and when the right thumb touches the selected point, the rest of the hand continues forward. The resulting 'stretch' and the tactile and visual feedback trigger a 'power grasp' of the left forearm with a balanced action of the intrinsic and extrinsic muscles.

By varying the positions of his arms, the patient will encourage automatic flexibility of his right hand.

The Human-Type Hand-Grip

We can now bring up to date the story, approved by Le Gros Clark and Raymond A. Dart, of how our remote ancestors improved their hands by altering their mode of travel and the reflexes in their eyes and hands by changing from 'branch-running' to leaping through the forests with some swinging by the arms; Le Gros Clark shows that they were agile versatile animals.

Some recent experiments on primate vision by Dr. Nicholas Humphrey throw light on both the ancestral and the patient's reflexes. In the former, whilst the animals were travelling through the forests, the forelimbs were extended forward under labyrinthine influence, whilst in exercise 4 the patient carried his right hand forward voluntarily. In both cases the resulting forward movement of the thumb across the field of vision caused the animal's and the patient's visual attention to be attracted to the thumb. This supplements the eye/hand interactions, described above under primate grooming as well as in exercises 1 to 3. As a result of this integrated feedback the pad

of sensory impulses from the labyrinth, eyes and neck.

of the thumb strikes precisely on the selected point on the branch or forearm on which the eyes are focused. This obviates bungling of the stretch reflex which triggers the intrinsic muscles.

The resulting balanced power-grip must have been the basis of the weapon and tool techniques, described by Dart in his book on *Man-Apes in Africa*. It also provides a step towards the rapid recovery of skilled actions during rehabilitation of the hand.

Conclusion

The use of primate reflexes in the rehabilitation of the hand provides a basis from which hand-skills can be rapidly recovered. The approach enables the patient to utilise personal aptitudes to restore the effectiveness of his hands.

The novelty of the treatment is the patient's use of multiple feedback emanating from his voluntary actions.

NOTE: This is a shortened version of the original article, copies of which have been lodged in the library of the Chartered Society of Physiotherapy.

ACKNOWLEDGEMENT

The author expresses appreciation to Miss P. J. Waddington, M.C.S.P., Dip.T.P., for her help in preparing this article.

REFERENCES

- Elliot Smith, G. (1927), *Essays on the Evolution of Man*, Oxford University Press, London.
- Clark, W. Le Gros (1971), *The Antecedents of Man* (3rd ed.), Edinburgh University Press.
- Clark, W. Le Gros (1971), *The Antecedents of Man* (3rd ed. Hart and Winston, New York.
- Humphrey, N. (1972), *New Scientist*, 53, 789, 682.
- Denny-Brown, D. (1966), *The Cerebral Control of Movement*, Liverpool University Press.
- Dart, R. A. (1959), *Adventures with the Missing Link*, Hamish Hamilton, London.

SOME USEFUL BOOKLETS

Research and Development Work on Equipment for the Disabled 1971. Report, under the Chronically Sick and Disabled Persons Act 1970, by the Secretary of State for Social Services, the Secretary of State for Scotland and the Secretary of State for Wales. H.M.S.O., 1972. Pp. 15. 13p net.

This paper reports on the 1971 research and development programme for medical equipment and hospital supplies. The Department of Health and Social Security sponsored projects on invalid transport, orthotics, and hearing aids while the Biomechanical Research and Development Unit and manufacturers continued research work on prosthetics. Hospital staff in day-to-day care of the disabled continued to improvise aids and modify existing equipment to suit the needs of their patients. The Scottish Home and Health Department provided money for research into prosthetics and a power tilting chair, and for hospitals which carried out work on prosthetics, orthotics, and wheelchairs.

Resettlement Policy and Services for Disabled People. A Department of Employment of the Disabled. Department National Advisory Council for the Employment of the Disabled. Department of Employment, 1972. Pp. 126. Tables.

This paper discusses the position of disabled people with regard to employment. Not surprisingly, the disabled are more liable to unemployment, although people with 'stable' disorders, such as injuries and amputations, are easier to place than those likely to suffer recurrent bouts of illness. A quarter of the people requiring resettlement each year are contending with a new disability.

The Department's present employment policy for disabled people and its specialist resettlement service are under pressure because the nature of disablement has changed over the past 20 years. The number of people on the register who were disabled during the two world wars has dropped, while there has been an increase in the number of people with age impairments, such as bronchitis, heart conditions, and arthritis, so that they now dominate the

register. The Department also has to place younger people with mental illness and nervous conditions such as epilepsy and spasticity. It is necessary to consider whether there should be one specialised resettlement service for everyone with a special employment problem, including the disabled.

Medical Engineering. Report of the Bio-Engineering Study Group. Scottish Home and Health Department. H.M.S.O., 1972. Pp. 42. 47p. Tables.

The Bio-Engineering Study Group was charged to encourage the growth of medical engineering in Scotland, and this report describes the present position of the industry and its defects, and goes on to make recommendations for future organisation. The Study Group visited Scandinavian countries, as they are active in the field of medical engineering, and the size and traditional skills of their population are similar to those of Scotland. It found that members of the medical profession are involved to a striking extent in commerce and industry.