OCCUPATIONAL THERAPY FOR ORTHOPEDIC CASES

NELL GREEN

Since prehistoric days, when the cave man was crushed by falling boulders, or mangled by an over-bold prey, the world has been confronted with the economic problem of the disabled man. For centuries his wounds were healed, but no real attempt made to correct his disability, until the latter part of the nineteenth century, when reformers began promulgating the theory that the cripple was an economic loss to the state. To the Danish government belongs the honor of the first great step in the reeducation of the crippled man, by the establishment of clinics and schools. Other nations were quick to grasp the idea, Sweden embodying it in the slogan “There shall be left in Scandinavia no cripple who can possibly become self-supporting.” Out of this humanitarian spirit have grown clinics and schools, wherein the unfortunates of life are taught to utilize to the greatest degree, the limbs and faculties still in their possession. Slowly the movement has developed in this country, until practically every great city has some center where the handicapped may be reeducated, located in gainful occupations, or find work within the scope of their physical and mental abilities.

The crushing disaster of the recent war has taught surgeons and laity that there remains still greater hope for the disabled. Reeducate him by all means, but first ascertain whether it be possible to prevent or lessen deformity. Why not follow up the marvelous surgery of the operating room with careful, supervised exercise which will lessen fibrosis, build up wasted muscle, improve nutrition and assist nerves in regeneration? Dr. Tinel, in his book “Nerve Wounds,” says “Inactivity of the wounded

1 Read at fifth annual meeting of the National Society for the Promotion of Occupational Therapy (now the American Occupational Therapy Association), held in Baltimore, Md., October 20-22, 1921.
limbs and moral inertia of the patient form the main cause of the irreducible deformities, the neuritic contractions, the functional paralyses that accompany organic paralysis." The need for graduated exercise in the orthopedic case is equally great, since the function of a joint is mechanical, and disuse will retard cure, often resulting in chronic inflammation. It is an accepted fact that frequently the immobilization of a limb in a splint causes greater deformity than the original injury. The army method is first, prevent, then correct, and as a last resort, substitute, movement. Every energy is bent toward preventing deformity, but once it exists, the next effort is directed toward correcting it, restoring joints to normal positions, placing stretched ligaments and tendons in position to contract, with mechanical aids where necessary, or by voluntary movement if possible.

To meet this need, at the instigation, and under the direction of Drs. Brackett and Goldthwait, four years ago, army hospitals established curative work shops, where the patient works for a stated length of time, under the supervision of trained aides, with tools so constructed as to mechanically lessen his disability, and tend to correct his deformity. After the wearisome convalescence, the depressing atmosphere of suffering, the dull monotony of mechanical apparatus, all of which tend to lower morale, the patient finds himself in a wholesome environment, surrounded by industrious friends, who are constructing things of real value, and is reminded of his disability only when the careful aide tactfully corrects a position that would prove injurious, or warns him that it is time to lay aside his work for the day. No longer is he treated as an invalid, or worse, a cripple—a word that is forbidden in all army hospitals—but as a normal man, laboring under a temporary misfortune. The day he begins curative work, he hears, apparently by accident, of cases similar to his own, which were greatly benefited by occupational treatment. He is made to realize that his improvement depends largely upon himself—that if he is conscientious about attending assignments, he will regain much of the lost muscle power. That the patient is a normal, capable man, not a helpless object of pity, is the spirit that pervades every army workshop.
At Walter Reed Hospital, the aide at the head of the curative department, and the head aide from the physiotherapy department, attend formal inspections with the chief of the neuro-surgical service, and occasionally with the chief of the orthopedic service, taking notes upon the condition of the individual patients. Those whom the surgeon specifies as physically fit for exercise, are assigned to curative and physio-therapy treatment. The occupational aide makes out the assignment slip, giving patient’s name, ward, diagnosis, and, in orthopedic cases, checking the motion desired, taking the slip to the physician for signature. The nurse sends the patient, with this slip, to the aide who makes the assignments. She examines him, tests joints and muscles for range of motion, and tells him in what shops he will receive the greatest benefit. Inasmuch as Dr. Bowman, who was largely instrumental in establishing the psychological laboratory at Walter Reed, is to speak upon the methods and appliances for testing and measuring the strength and range of motion of all joints of the extremities, I will not attempt to discuss them further than to state that it was in large measure owing to the efficiency of the psychological laboratory that the curative department at Walter Reed attained its widest scope of activity.

After being tested, the patient is given his choice of work, restricted only by its therapeutic value. He is introduced to his environment, where the mechanical processes are explained to him, and furnished with the requisite material. The army permits every patient to keep the projects he constructs, supplying him with a limited amount of material, with the exception of the patients who are doing curative work, under medical orders. They are allowed an additional amount commensurate with the time they are required to work. With these two incentives, then, the desire to attain the maximum physical improvement, and to possess the completed project, the patient strives to produce an article of real value, and finished workmanship.

When a patient is assigned to the curative occupational department, one assignment card is sent to the laboratory, where the psychological tests are given. A weekly report of the patient’s gain or loss is made to the head aide, who, in unusual cases, of
either gain or loss, makes a report to the ward surgeon. When there is a continued loss, the aide with whom he is working, is interviewed, and often the physio-therapy aide who massages him, in order to ascertain the source of trouble. As a result, the period of work is lessened, or the character of work changed, with the consent of the ward surgeon. At Walter Reed undoubtedly the greatest factor in the development of curative work, has been the inspiring coöperation of the doctors, who have given generously of their time and advice. Of course, no physician has the time or inclination to go into the matter of whether a man shall make a rug, or carve a lamp. He gives medical advice only, stating that his patient must have dorsi-flexion of the wrist, or he must not have plantar-flexion of the foot, as the case may be. It is the province of the aide to know which shop will fill that requirement, and she is answerable to the physician for the well being and improvement of his patient.

Since we are endeavoring to raise the standard of our profession, would it not be preferable to educate the aide, rather than the busy and highly trained physician? Every aide should have—not a smattering of anatomical training, but a thorough course, which will fit her to receive a physician's orders understandingly, and without explanation, even as a nurse takes orders. The time is coming when aides, as well as doctors, will be specialists. We are working toward that end. We now have aides who are making a special study of psychiatry and tuberculosis, but to this we must add the unlimited fields of orthopedics and neurosurgery.

All shops are equipped with apparatus to meet the needs of type cases, such as adjustable seats, and especially adapted handles and treadles. In the carpenter shop the handles of tools are modelled with dental compound, in order to fit hands so badly fibrosed that the fingers cannot grasp them. Planes have knobs, in sizes varying from a 3-inch diameter, down to the ordinary size. Drills are fitted with hand devices, as well as power connections, to enable the man with the FCC of the humerus to flex and extend his shoulder. Foot-power saws are fitted with removable, wedge-shaped blocks, that maintain the foot in a dorsi-flexed
position, permitting of no plantar-flexion beyond 45 degrees. There are also blocks, fitted on treadle saws, for eversion of the foot, for flat foot cases, each block being made to fit the patient's own shoe. In the rug shop, beaters are hung at angles accessible to elbows, partially ankylosed or otherwise limited in range of motion. The warp of the Gobelin tapestry loom is loosened to conform to the limitation of fingers weakened by arthritis. As the patient works his way back to strength, this mechanical help is gradually withdrawn, in proportion to the restoration of function, until he is using tools requiring normal range of motion.

The Walter Reed curative department embraces the weaving, jewelry, wood and basketry shops, the majority of the orthopedic cases being sent to the wood shop. Since time forbids the enumeration of the various devices peculiar to each shop, a résumé of a few type cases may give some idea of the opportunities occupational therapy offers the orthopedic service.

Private G. W.  Gun shot wound of thumb of left hand, with limitation of movement of the thumb; assigned to rug shop for increased abduction, adduction, with flexion and extension of the thumb. Patient used Gobelin tapestry loom, where separating and holding out threads of warp extended and abducted thumb. At first his hand was so weak, the threads of the warp had to be loosely drawn, and he had no active movement in his thumb, being compelled to use his right hand in placing threads over injured thumb. At the end of five weeks the left thumb was functioning to the extent that it no longer needed the assistance of the right hand, but could lift the threads by voluntary action.

Private J. S.  Gunshot wound of left elbow and forearm, with resulting compound comminuted fracture of the ulna, limitation motion. Assigned to rug shop for flexion and extension of thumb, fingers, wrist and elbow, with caution to avoid elbow fatigue. He was started making Turkish rugs, as the tying of the knots involved finger and wrist flexion, slight extension and very little elbow movement. He completed a Turkish rug, and made one with the more intricate Persian knot, which necessitated more elbow flexion, extension. In addition to greater technical skill, he gained 20.5 degrees voluntary flexion extension of distal joint of the fourth finger.
Private A. G. Extensive burns hands and face. Patient assigned to rug shop, where he used Swedish loom for flexion extension of fingers and wrist, and to strengthen grip of both hands. When he began working, he could not flex fingers, owing to stiff and sensitive condition of skin of hands. He used a very light loom and small, light shuttle, which he grasped with thumb and fingers extended. He held the beater with the palm of his hand, making an effort to flex fingers a little. Gradually he increased the period of work from one-half hour to four hours daily, was able to handle the heaviest loom with ease, and could grasp firmly any kind of shuttle or beater.

![Chart 1: Range of Motion—Right Angle Plantar Flexion](chart)

Sergeant W. M. Partial division of tendon of Achilles. Patient assigned to use of upright treadle saw for plantar-flexion of right ankle. He made a number of jig-sawed pieces of furniture, gaining 18 degrees plantar-flexion. He received neither massage nor gymnasium work. The chart illustrating his progress is on display.

Captain M. K. Gun shot wound perforating right ankle, resulting in partial ankylosis of ankle. He used a seated treadle saw for increased range motion of the metatarsal joints. To his great delight, he gained not only motion in the metatarsal joints, but in the ankle as well.

Private D. O. Partial ankylosis of wrist, due to infectious arthritis. This patient began curative work in the ward, the aide assigning him to
rake knitting for flexion of fingers, thumb and wrist of left hand. At first he could scarcely grasp the rake, but gradually voluntary movement increased, until his aide reported his improved condition, and he was sent to the curative wood shop, where he did wood carving, using a mallet, the handle of which was modelled with dental compound. As his grip improved, the amount of compound was reduced. In addition to doing very good work, and acquiring skill with tools, he strengthened his grip until he could grasp small objects. Two of the carved boxes on display in the exhibition are the work of this patient.

Private H. K. Compound fracture of left humerus with limitation of motion of the shoulder and elbow. He used post drill and plane, hammer and general carpentry tools for flexion extension, ab-adduction of the shoulder and elbow. He made a locker, gaining 30 degrees elbow flexion extension, 36 degrees shoulder ab-adduction, and 68 degrees shoulder flexion extension. Measurement report on display.

Corporal J. L. Old compound fracture of second, third and fourth metatarsal bones of left foot, with osteotomy of head of third metatarsal. Patient used double treadle saw for flexion extension of the toes and mid-tarsus, with a gain of 12 degrees flexion extension, 12 degrees inversion, eversion.

Sergeant N. B. Compound comminuted fracture of left radius, ununited, old compound comminuted fracture of tibia; partial loss of extensor muscles. Assigned to jewelry shop, where he used hammers, mallets, and bellows to strengthen grip and wrist. The first week he worked only a few minutes, holding large pieces of copper, which he raised into bowls. The vibration from the hammering and the effort required to hold the copper in place, as he raised it into bowls, brought into play both flexor and extensor muscles. He increased his period of work from a few minutes to two hours daily.

These are but a few of the great number of orthopedic cases benefited by occupational therapy. In considering this subject, it has been difficult to ignore the subject of neuro-surgery, as the two are so closely allied, few severe fractures escaping without nerve injury. The rug and jewelry shops have been particularly successful in the treatment of neuro-surgical cases. In the rug shop the light movements of weaving are essentially
adapted to delicate nerve injuries, building up muscular tone, preventing fibrosis condition of the joints and atrophy. Musculo-spiral cases have been greatly helped by using the Gobelin tapestry loom, where the spreading of the threads extends wrist and fingers and abducts thumb. Note the following case:

Private W. G. Musculo-spiral nerve paralyzed. When he began working on the Gobelin loom, the tension was kept very loose, and the heddles kept quite low, owing to the limited extension of his elbow. He increased the period of work from one hour, broken up with frequent rest periods, to two hours steady work. The loom was readjusted until he was able to use it with the heddles at the accustomed height, and tight tension. He gained 1 pound strength, showed decided improvement in flexibility of muscles, and there was a pronounced gain in subjective sensation.

Corporal E. W. Could not flex his fingers, his hand presenting the typical griffe deformity of ulnar paralysis. After working on a Norwegian loom for two months, he could not only grasp firmly any object, but the deformity was lessened, so that the hand could be almost straightened out.

Light looms, threaded to require two treadles for each shed, have been very successful in restoring muscles atrophied from paraplegia or hemiplegia. In the jewelry shop the use of small tools has been a great aid in strengthening flexor muscles, flabby and weak from interruption of the median and ulnar nerves.

M. J. Right ulnar nerve paralyzed. Assigned to jewelry shop to strengthen grip and increase flexion of thumb and fingers. He used small tools, such as pliers, tweezers and small hammers, and did quite a bit of drawing of wire. His strength of grip improved 15 kilos, and wrist flexion 16 degrees.

Sciatic nerve cases are sent to the wood shop and rug shop. In the former, patients use pedal saws, with seats adapted to the range of motion of the hip joint.
Sergeant J. M. who was assigned to pedal saw for sciatic paralysis, gained 24 degrees dorsal flexion, 17 degrees ab-adduction and 4 degrees-plantar flexion. Patients with external popliteal paralysis are assigned to treadle saws, the injured member being held in place with a toe strap. The well member does the work, the injured member receiving almost passive dorsal flexion; no plantar-flexion beyond 45 degrees. Wood turning and wood carving are given to the patient with median and ulnar paralysis. The chart of Private C. B. is interesting. Paralysis of right ulnar nerve; assigned to wood work, he attained normal wrist function, a gain of 20 degrees flexion, 11.5 degrees extension, and strength of grip increased 15 pounds.
The results obtained from curative shop work in the field of functional paralyses are most gratifying. The patient makes apparently phenomenal gains, all of which he accredits to the therapeutic value of the tools or machines used. The opportunities in this line need no discussion, as they are self-evident.

Although this paper has given, at best, but an incomplete idea of what occupational therapy may accomplish in conjunction with orthopedic surgery, it may serve to indicate, in a measure, the breadth and possibilities of this comparatively new and undeveloped field.
THE IMPORTANCE OF MEASUREMENT OF MOVEMENT IN ORTHOPEDIC CASES

ETHEL BOWMAN

With the first orthopedic cases which came to the notice of the Department of Reconstruction at the Walter Reed Hospital, it was evident that the mechano-therapy of the Canadians had one advantage over occupational therapy as it had been adopted for use in the hospitals of the United States. The various pieces which Dr. Bott had devised for the exercising of disabled limbs, were each fitted with a measuring scale which registered the amount of movement. This idea of using measuring methods had been put in practice by Dr. Shepherd Ivory Franz, who, in his re-education of cripples at St. Elizabeth's, had realized the importance to both patient and physician, of this objective record of progress. He had for years been using apparatus for the measurement of the various bodily movements, and had proved its value both as incentive to the patient, and as a source of accurate information to the physician.

This problem at the Walter Reed was given by Dr. Baldwin, the director of occupational therapy, to three workers in the Psychological Laboratory, John Wallace Baird, Ethel Bowman, and Adam R. Gilliland. Apparatus was devised and manufactured, largely by Mr. Gilliland, and methods of procedure were laid out. Measurements of the voluntary movement possible in the involved joint were taken at stated intervals, and the records kept in tabular and graphical form. Later, the strength movement was tested by the Martin method by Capt. Richmond. These records were posted where the patients could see them. It was a surprise to the workers to see the intelligent interest taken by the patients in these records of their progress. Even the illiterates understood that a rise in their curve meant a
gain while a drop meant a loss. We believed also, that the real volitional effort put forth for the sake of the movement itself, gave them an experience of voluntary action and what it could accomplish, as no other part of their work was doing. An account of this work was published by Dr. Baldwin in a Walter Reed monograph, "Occupational Therapy Applied to Restoration of Disabled Joints."

Later, Mr. Gilliland was able to carry out this procedure in a more systematic manner, with apparatus brought to a greater degree of perfection, in the hospital at Colonia. The account of this investigation alone, without reference to the previous work, is published under the title, "Metrotherapy, or the Measurement of Voluntary Movement; its Value in Surgical Reconstruction," is published jointly by him and Col. Fred H. Albee in the Journal of the American Medical Association, October 9, 1920; vol. 75, pp. 983–986.

The value of this psychological factor in occupational therapy is suggested to those who are working with orthopedic or peripheral nerve cases.