

*1960 Eleanor Clarke Slagle Lecture*

## **Devices: *Development and Direction***

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### **Preface**

As the sixth occupational therapist to receive the Eleanor Clarke Slagle award, I find myself not without a feeling of great humility as well as one of pride. I am respectful of the achievements and high standards of my predecessors and also of the many other occupational therapists who have made and are making a fine contribution to our profession. Thus I am most honored by this confidence you bestow upon me and hope I shall be worthy of it.

I should be remiss if I did not say that whatever I have learned has not been due solely to my own efforts nor to my own inspiration nor to what I am. For I have been fortunate in knowing and working with so many very wonderful people, each of whom has played a significant role in my growth and understanding. To all of them I am deeply indebted for their faith, encouragement, counseling and guidance which have directed my path. My only regret is that it is not possible to name them here; the list is long and I could not be happy with any omitted. To both professional and personal friends, and to my own understanding family who have suffered growing pains with me, I wish to express my deepest gratitude.

### **Foreword**

We need no temple gong, village bell, television commercial or other fanfare to quicken the pulse and the pace or to get attention for a discussion of the use of mechanical devices or aids which have become by now an integral part of the rehabilitation procedure. We are no longer skeptical as to whether this ought to be the concern of the occupational therapist. We know only too well what has been and can be accomplished for the physically disabled patient by the application of mechanical inventions. And we are fortified in our enthusiasm by rapid technical advances.

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Just why we should have waited so long to consider the fact that man has always made use of such skills to help himself is perplexing. It might in part have come when it was recognized that we did not necessarily do the patient a service by doing things for him and that we aided only when we helped him to help himself. Perhaps it could simply have been the result of man's inventiveness coming to his rescue out of necessity, in this area of his life as well as in others. By whatever circumstances it evolved, we can only be delighted that it happened and comforted that from mankind's tragedy came also his means of escape.

Yet not every therapist may have as much time at his disposal as he would like for participation in such helpful procedures. He may also still be meeting some frustration in the form of lack of cooperation from staff in other services and lack of referral. And there may be others who seek more and better ways for advancing the knowledge and skill already available.

It is then at this time my pleasure to present a discussion of this exciting aspect of treatment.

During these past ten years of investigation and search into practical and satisfactory devices to help achieve independence for the physically disabled, a basic philosophy and a technical approach to selection of the proper devices have been a natural development. Trial and error methods, if carefully observed and studied, must lend direction to further pursuits. In 1956 I presented to this same body, at the annual conference in Minneapolis, some of my first organized findings. The analysis discussed at that time consisted of the following approach: (1) evaluation of the patient's physical needs; (2) evaluation of the psychological factors involved in use of special devices; and (3) selection and design of suitable materials and methods of fabrication in relation to the first two factors.

It is not my intent to repeat what I have said before, but to present any additional findings that have refined and improved former methods and which still leave a challenge for future growth.

The study of physical needs by analysis of motions used in the performance of various activities has pinpointed for us the specific losses to be compensated for, either wholly or in part. Through observation, the process of eating has been described and charted. This has shown us which motions are used and for what purpose. We have had some indications also as to relative importance of each of the motions, the extent used and whether it is an "active" motion or a "holding" or "stabilizing" motion.

Such studies are naturally based first on motions as observed in a "normally" functioning arm. As such, our analysis seems relatively simple—especially as we all have very similar habits and patterns, due to our common anatomical structure and the fact that we have all been taught a similar way of accomplishing various activities.

We must realize, however, that even normal functioning varies, and since the upper extremity is fitted to perform many activities, the motions that we use for one activity do not necessarily require ALL the movements available. Thus, if we are minus some of the usual motions in eating, for example, we may still easily be able to manage quite satisfactorily. This we can observe frequently in many of our patients. Often the substitutions or variations are hardly discernible or are performed with such efficiency and ease that we are not quick

enough to detect them immediately. This is apt to be true when the loss is minimal or when it is confined to only one location or joint. Here, substitution of either another body motion or use of a device is relatively easy to achieve.

But let us take the patient who may have multiple weaknesses or losses, the one who may be classified as having so much and yet so little. Here the dynamics of motion become much more complex. Let me illustrate with the problem as presented by a rather typical disability limitation such as is often found in the patient with quadriplegia as the result of a spinal cord injury. Upon examination it is found that elbow flexion tests good, extension is zero, shoulder flexion is poor or trace, but abduction is fair plus to good minus, supination and pronation are fair, wrist extension is poor plus to fair minus and grasp is zero. There are no range of motion limitations. This patient, if left to his own resources, might be able but for lack of grasp to feed himself, if he were so motivated. But you would probably observe a rather bizarre pattern of motion. The arm would be raised outward by shoulder abduction to shoulder height, then the hand brought in toward the mouth. (One must also remember that in such patients trunk balance is apt to be very poor, so that they cannot bend forward to meet the hand; and wearing a neck collar will further lessen their ability to compensate in this direction.) Another reason why you will find such patients using more shoulder motion than elbow flexion, even though the shoulder is weaker, is that by so doing they eliminate the problem of hitting themselves in the face. This situation is due to lack of triceps muscle, which comes into play after the forearm is raised to a vertical position and then drops toward the face.

According to this report, it would seem that only a substitute for grasp and some assist for shoulder flexion would provide the needed aid and the preferred eating motions. A simple device such as a leather utensil holder or a built-up handle will provide a substitute for grasp. Either an overhead sling with one support under the elbow or a ball-bearing arm support with "flying saucer" used as elbow rest (both standard devices) may be used for providing shoulder flexion positioning.

Such devices, however, have been found to enable only partially satisfactory performance. Too often I have found that the shoulder assist as described above did not accomplish what was expected of it: rather, the patient was frustrated and hampered. Instead of using the support, he is apt to revert to his own substitution; and this bizarre pattern may put undue strain on the shoulder, often bringing on early fatigue and sometimes pain. Why is not the flexion assist as described helpful? We have observed two principles of dynamics which seem to contribute to this happening. One is the result of the type of device used to substitute for grasp. In equipping a patient with a holding device, we must remember that the most frequently used devices position the utensil as though held with a hook grasp rather than pinch grasp. This is not the usual grasp of adults. Also, hook grasp positions the forearm in pronation rather than the mid-supination used in pinch grasp. As a result, when picking up the food, because further rotation of the forearm is impossible, some rotation and abduction of the shoulder is usually necessary. This automatically lifts the elbow from any support provided. Once lifted, the natural tendency is not to lower the elbow to the support and use elbow flexion to bring the hand to the mouth, but to continue shoulder abduction and, as described before, bring the hand to shoulder height and then toward the mouth.

What then should be done? A holding device utilizing pinch grasp may be provided, although thus far any device made for this purpose is far more complicated than those designed for the hook type of grasp. If a fork is used, the tines can be turned down rather than up. Or the fork end can be bent downward. This works very well unless the food is too soft or slippery in which case it may be lost before the fork is partially raised. Some wrist flexion and ulnar deviation may be used as a substitute, and the normal individual would employ these other motions. But when some weakness of the wrist is present, wrist strength is apt to be utilized mainly for a stabilizing force, which is also one of its purposes. The presence of a wrist splint may impose further limitations.

Of the two shoulder flexion positioning assists, I have found the overhead sling with elbow supports the most helpful. The sling ought to be equipped either with a spring of the correct length and tension or with a device to provide similar action. Then, as the elbow is raised up and away from the body, the sling shortens, thus keeping the elbow-piece under the elbow, ready to support it and encourage its use by lowering the elbow before raising the hand to the mouth. This sling support is simple, but it is also conspicuous. Moreover, there must be some conscious effort and cooperation on the part of the patient to make use of the support as intended.

It is rather obvious from the above-presented description of dynamic functioning that we are still in need of better assisting devices. It should remind us that we are dealing with a part of the body in which more than fifty muscles, wonderfully constructed, are working together for an integrated performance. When the loss of function is minimal and confined to one joint or motion only, the problems arising are relatively uncomplicated. Also, when total function is lost, a fairly satisfactory substitute performance can be achieved through a contrived mechanism. Yet, to aid satisfactorily when there is a multiple combination of varying degrees of loss of function, and to keep pace with adjustments needed as function improves, meanwhile making certain that undesirable motion patterns or substitutions are avoided, requires careful evaluation and proper selection of equipment.

Let us further examine this human tool, the upper extremity. To assist mechanically the functioning of all the components of hand and arm requires as varied an approach as mathematical law dictates for possible combinations of the many units involved and the varying degree of participation of each.

An early study made by the engineering department of the University of California was entitled "Studies to Determine the Functional Requirements for Hand and Arm Prostheses." Because of the need to sort out of all of these movements those that would be most useful, the kinematic analysis of the motions of the activities of daily living was one of the main aspects of the study. Those conducting the study scientifically determined, through many engineering processes, the most useful types of hand grasp. Of the two needs, (1) to pick up an object and (2) to hold objects, it was found that the pick-up motion most frequently used a lateral grasp (58 to 34) with the thumb against the lateral aspect of the index finger. The hold-for-use motion most frequently employed a palmar prehension grasp (64.5 to 34) with the pads of the thumb tip and first two finger tips together. It was found that both grasps were about equally employed. However, it was also found that palmar grasp could be used to

substitute for picking up many objects normally using lateral grasp. It was not so with substituting lateral grasp for palmar. Therefore the hand prosthesis was designed to provide a palmar prehension as the most useful motion for the hand.<sup>1</sup>

These hand activity requirements would be the same whether a prosthesis or a splint is desired. Hand splints are also designed to provide a palmar prehension type of grasp. This is true of both the Warm Springs type of opponens hand splint and the flexor hinge tenodesis hand splint.

So far, this last analysis has considered only the hand or terminal device. While it can be studied separately, it is also dependent upon arm function for placing it in a position of use. Let us consider each of the arm parts and its contribution to the total hand-arm functioning.

The wrist as a positioning device is well known. Most persons agree that either a neutral or a slight cock-up position, if there need be any limits set, is the most useful. This is perhaps true. However, depending upon the type of object grasped and at what height it is in relation to the body, other factors must be considered in any analysis, such as whether other accommodations are possible, as supination and pronation, internal and external rotation of the shoulder or trunk, or body bending. Again, citing the study by Boetler, Keller, Taylor and Zahn as an example, it takes 42 degrees of supination of forearm for picking up a plate. The action can be accomplished if only 30 degrees of supination are present; however, there must be additional compensations, such as depressing the arm or bending the body to the right.<sup>1</sup> Nevertheless, while this compensation may be anticipated as a possible and satisfactory accommodation in the average amputee, it generally is not possible to expect many persons with frail upper extremities resulting from poliomyelitis or a spinal cord injury to do this.

Elbow flexion and extension are obviously important in most activities and are provided for fairly easily. The motions or various positionings of the shoulder are complex and again, as in the hand, realistic replacement of all of them is almost impossible, at least today. Stabilization against the force of gravity, some flexion and abduction and some internal and external rotation are probably the most useful.

Let us go back for a moment to the selection of a suitable design for a functional splint for the hand. The pinch type of grasp has seemed to prove the most useful, yet the design as now used does not seem to be totally adequate. In various patients we have tested with this device we have found that many objects are still difficult to pick up. The difficulty seems due, largely, to lack of ability to position the hand. And if we observe an amputee using a hook we will find that even with his many arm and body accommodations he may have to pre-position the article. If these accommodations or the ability to position the hand are impossible, then we must often accept limited performance. Just recently a patient whom we were fitting with a splint was experiencing some of these difficulties, and he offered us a suggestion for possible improvement in the present flexor-hinge hand splint, which was designed to position and stabilize the thumb in abduction and hold the interphalangeal joints of the first two fingers in slight flexion. Motion (of a hinge type) is provided at the metacarpal-phalangeal joints. When the wrist is in a cock-up position, picking up objects is difficult. If, however, pinch grasp were provided by stabilization of just the interphalangeal joints of fingers and thumb, while motion (opening and closing of grasp) occurred in both fingers and thumb, then pick up might be

easier. This means another moving part and usually that complicates any device. However, the suggestion as mentioned to us is being tried experimentally and a sample splint has been constructed with very good mechanical results at the time of this writing.

We have not had time to use this splint on a patient. Therefore, it is only a first-test model and cannot be classified as good, poor or bad. Rather, it is being shown as an illustration of how, when a specific problem is defined, an attempt may be made to solve it (Figures 9.1, 9.2, 9.3, 9.4). The only results we can state at this moment are that less wrist motion is used and more opening of grasp is obtained. Wrist motion required in the original model was approximately 70 degrees. In the new design, it is 25–30 degrees, or less than half. Opening of grasp was increased from  $2\frac{1}{2}$  to  $2\frac{3}{8}$  inches. It is possible, however, that the new design may call for greater strength for operation, which could negate the advantages.

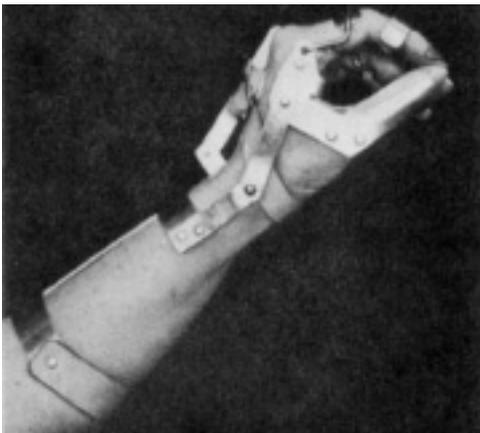


Figure 9.1. Hand splint (old design) with wrist extended and fingers closed.

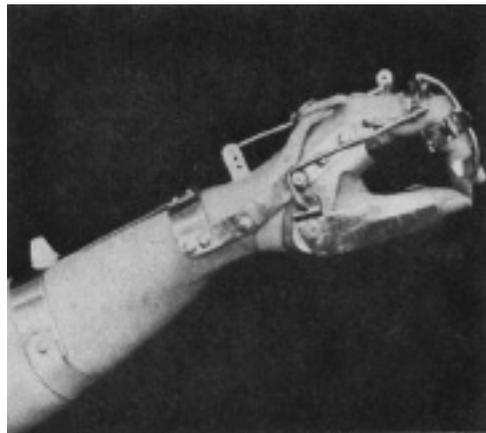


Figure 9.2. Hand splint (new design) with wrist extended and fingers closed.

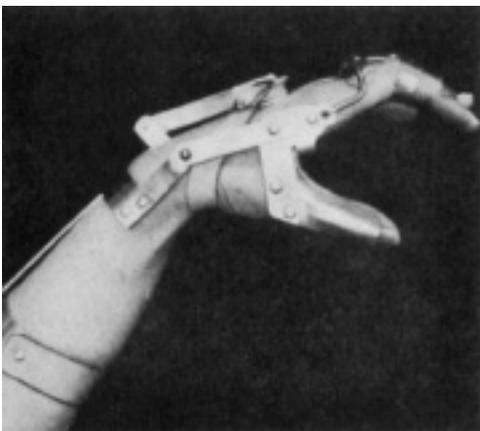


Figure 9.3. Hand splint (old design) with wrist flexed and fingers open.



Figure 9.4. Hand splint (new design) with wrist flexed and fingers open.

Again, we have presented another functional problem to illustrate the extent to which our present knowledge and efforts are still limited, in terms of our needs. A helpful procedure to follow would be (1) to evaluate for loss of necessary motions for a specific activity; (2) to select devices to compensate or substitute for lost motion; (3) to note whether devices provide for a normal functioning of the specific part or whether they impose abnormal patterns; and, (4) to note substitute motions imposed because of abnormal patterns and adjust the equipment accordingly.

Such studies as are currently being undertaken by the University of Michigan in their research program on orthotics should be most helpful to all of us concerned with this field of rehabilitation. One in particular<sup>2</sup> is the study of total arm function for specific activities in relation to space, a study being made on a much broader scale than ever before attempted. A parallel might be drawn here with motion studies made in the field of homemaking in which it was shown that the most frequent trips made in the kitchen are between the sink and the stove. The resulting energy-saving principle arising from this situation is that these two pieces of equipment should be placed in close proximity. When this is not done, ways and means of compensating must be provided.

Thus far I have discussed only additional problems of one factor, namely, that of the study of motion in relation to physical needs. The second factor is that of the psychological implication of devices to the patient.

Many of the responses of the patient are the same as those he exhibits toward the disability itself and are, of course, the psychologist's concern to evaluate, not ours. But we can recognize also some attitudes directly related to the devices and we ought to be aware of why they make an additional emotional impact. I believe the sociological attitudes of our society are greatly at fault for much of what occurs. The term independence to most of us, for example, is apt to mean sheer physical strength. And in today's world this is not so strange, as often the non-disabled are hard put to keep pace with work and leisure activities of a busy and highly competitive culture. Here, however, is a paradox. Although man thinks of himself as physically capable of taking care of himself, he at the same time strives to help himself more and more with mechanical inventions.

Let us look for a moment at the busy executive. He gathers information, communicates it, and directs much of his business via the telephone, intercommunications system, dictaphone and possibly TV or radar viewing screens. Most of the time while doing this he sits behind a desk in a chair. Physical energy used is at a minimum. This same person, as a good many other citizens of today, probably whisked himself out of bed in the morning, got ready for the day and traveled to work using many other mechanical devices such as modern plumbing, which provides instant hot water at the turn of a tap; an electric razor, electric stove, automatic coffee maker; packaged or frozen foods; a bus, taxi, automobile or subway; and an elevator to lift him from the ground floor to wherever his office is located. Whenever I am in our workshop and glance out for a moment to the towering structure of the Empire State Building, I am reminded of the fact that without elevators this building would be only an empty structure, except for a few rugged individuals; and they would undoubtedly be found on the first ten floors, with just possibly an isolationist above, rejoicing in his ivory tower.

Man has continually striven to extend his power beyond his own physical ability. Could we learn of the heavens beyond our reach without our great telescopes? And now we are designing rockets to take us to these great outer spaces. From the beginning of the discovery of flint and the invention of the wheel, man has steadily reached forth for new and better ways to help himself.

This being so, why should any person resist using devices just at the very time they can mean so much to him? Let us look at the other side of the picture. The ideal of the anatomically perfect person is shouted at us from the pictures and slogans of advertising, from road signs, magazines, radio and television. So the need for outside assistance is like adding insult to injury. If any of us has any doubt of the real importance of this trauma to the ego of the individual, I can ask you to reflect on how so many of us react to the more or less accepted use of eyeglasses, hearing aids and even certain easily recognized styles of clothing. Spectacles are given all sorts of added glamor in the form of color, shape and decoration; or contact lenses deny the presence of glasses altogether. Hearing aids are mounted behind the ear, some on the ends of spectacle bows to make them less conspicuous. I have come across an advertisement by a hairdresser in which he showed hair styles designed to hide a hearing aid. And certainly the manufacturers of our nationally advertised commodities make use of a real or fictitious person who represents the American ideal to enhance selling appeal. Have you ever noticed how often this person is a handsome Adonis or a rugged outdoor sportsman or both? Why do we cling to such ideals? Probably because physical perfection represents strength and beauty. We still need reminding that there are other types of strength and beauty besides that which we see—goodness, truth, achievement and thoughtfulness.

It is all too infrequently that we see an advertisement representing these other qualities. But we do have them occasionally. One that I clipped showed the “egghead” modeling a new style boy’s shirt. A well-known magazine, which is famous for typifying the American public, showed on its cover the college campus with the girls clustering around the top science student while the football hero passed by unattended. And some of my colleagues may have heard me comment on one of the cigarette ads which purports to appeal to the “thinking man.” (Even so, the “thinking man” shown usually has a spectacular hobby.)

We must remember that ages ago, when many of these concepts had their origin, brute strength was important. Survival often depended upon it. And we must admit that in those days it was man’s greatest attribute. The person who survived by his wits was rare. Because of these occasions brains were given a high regard even then. But there was little opportunity to use them and physical labor was paramount. Today, we live in a different age, a highly mechanized one. We employ all our ingenuity and skill to improve our lot. Is there really much difference between the robot arm which aids the man in the atomic laboratory to handle radio-active material and the artificial muscle and CO<sub>2</sub> which enable a powerless hand to pick up and hold the objects necessary to his daily activities? There is nothing really unique in the dependence of the physically disabled upon equipment except in the degree and type of design for operation. And it would be helpful to all of us if we could remember the

philosophy of Antoine de Saint Exupery that just as man has created these many tools that he uses, he is also master of them and slave only when ignorance and prejudice keep him from trying to help himself.<sup>3</sup>

It may seem that I have been talking rather at length concerning man's use of mechanical aids. However, if we are going to be working with patients who need such equipment, then we cannot lightly ignore such influences but must deal with them. We do our patient no service by stating merely, "He is uncooperative" or "He does not wish to help himself," and by feeling that he must automatically consider us the angel of deliverance from his problems.

What can we do then to make these devices acceptable to the disabled? I believe there are several definite courses of action to take. One method of making equipment more palatable is to introduce it into the treatment program as early as possible. This takes away from that stigma of being "the last resort," which is inevitable if devices are sought only after all other measures have failed. It is easier to accept help in the beginning with the hope that it may be discarded later—as well it may be, for recovery comes for some—and it has been found that devices can have some part in enhancing the possibility of recovery of skills. Also, familiarity with equipment can lessen the threat of its continued use, if such is the need. Let me give one example to illustrate the early use of devices.

Sometime last spring I was confronted with a challenging situation which called for definite action. A patient in his early twenties, a first-year medical student and a victim of Guillain-Barre syndrome, was referred to the service for evaluation in terms of supports and other self-help equipment for the upper extremities, both of which had very little muscle power in shoulders or elbows. The wrists and hands were fairly good, although not completely normal.

I first introduced myself and explained the function of our service. Whereupon the patient turned to me and stated very positively, "Of course, you realize I shall have no need of your services because by September I shall be completely well and back in medical school!"

Before I could make any comment he continued, "And I may as well tell you that in the other hospital, where I was before coming here, the occupational therapist tried to rig me up in all sorts of contraptions, treating me like a hopeless cripple."

I gulped inwardly, thought fast, and then replied, "Well, you are quite right in that devices are designed to help the person who is or may be permanently disabled to become independent; but they are used in other ways as well. They can be set up as therapeutic agents to provide independence while one is working on a treatment program. Can you, for instance, feed yourself now?"

The reply was, "No." So I explained that I could provide him with a device with which he could do this. The device, if properly set up, would do nothing for him that he could do for himself. It would only substitute for those motions that he could not make now. And as soon as any progress was made, adjustment would be made in the device accordingly, to gradually lessen the assistance as he became able to take over. He was then asked whether he would like to see the equipment. He agreed and was willing to give it a test. He was fortunately so impressed that we were able to set up the equipment for his use. For several days

he was visited regularly to check whether everything was satisfactory. He was then left to continue its use. Later, at an opportune time, I visited him again to see whether any changes were needed. When I remarked that possibly we might consider some lessening of the assistance, the reply was, "Oh, let's not do it yet!" The patient continued to use the equipment and gradually less and less assistance was needed. Today, fortunately, the patient does not need any aid for the upper extremities. It is not to be inferred that the apparatus provided was solely responsible for return of strength and function. Many other treatment measures were being provided simultaneously. But the patient was able to start performing many activities very early, and it can be assumed that the devices were contributory and did enhance other programs by providing early coordinate use of the arms and build-up of tolerance and skill.

In addition to the early use of devices, there are other measures that can be taken to insure their success and value. We can and should make the best devices possible. We must first be certain they will really serve the purpose for which they are intended; the study of motion, as described, helps to determine this. Then we must ask ourselves whether the device is performing as efficiently as possible. Is its operation simple? Free from breakdown or need of frequent adjustment? Within the understanding and grasp of the operator after a minimal amount of practice and supervision? Or is it inconspicuous, so as not to attract undue attention? Is it as near to the accepted mode as possible without being freakish? Is it cosmetic and attractive? In regard to the improvement made in eyeglasses, for instance, it should be recognized that not all the recent advances are a result of our need for ego-building or just to keep up with the Joneses, although we cannot deny this aspect of the picture. The use of color is pleasing and satisfying, and that, as well as the shape, can either add to or detract from one's appearance. And perhaps most important is design for function. Contact lenses certainly were originated with that purpose in mind. They are much more simplified than glasses and reduce the breakage hazard. They eliminate possible discomfort from pressure irritation on the nose or ear as well as interference of vision from the frames.

Modern designers are more and more alert to function and efficiency. While they do not yet advertise many of their products as designed for the person with a physical limitation, they do promote the fact that they require only one hand to operate and thus will take less effort to do the job. The development of improvements in kitchen and household equipment has been a real boon to any homemaker whether physically impaired or not. The major reason we have been so happy about our new Functional Home for Easier Living is that its selection and adjustment of features do provide easier living for anyone.

If you wish to remind yourself some time of these various requirements of equipment, let me suggest a simple method. Just ask yourself what you would demand. Let us look at clothes. Function and versatility: as few pieces as possible to serve as many needs as possible; easy and quick to put on and take off; design or style in keeping with today's fashion trends; becoming to you; wearability and ease of care; "travel-a-bility"; and, of course, a price within your budget.

These are high goals and to provide all of these answers is not yet totally within our scope. But if we try to do our best, so may the patients be more willing to try also.

There are two other brief thoughts that I cannot exclude. One is that although we must do everything possible to provide equipment to aid our patients, if this is the answer to their problems, we should never try to impose anything upon anyone just because it is one way of giving assistance. All equipment has its limitations and must be judged according to its usefulness and the need for it as against the disadvantages. Socio-economic factors also must be considered. A favorite story of ours at the Institute is that of the patient referred to ADL for dressing activities who finally said, "But do I have to learn to dress myself now when I've always had and will have a valet to do it for me?" Electric wheel chairs, as helpful as they are, are not the answer for persons going home to remote areas or underdeveloped countries where as yet no facilities for repairs or adjustments are available.

The last factor is that of patient participation. Full explanation from us of what is to be accomplished, leading to understanding by the patients, is the easier road to acceptance. In these busy days we often let lack of time rob us of this responsibility. Also needed is the willingness to listen to the patient, to his ideas or complaints. The patient not only feels that you are interested in him, but you may discover many interesting facts and learn better ways of doing things. For after all, it is the patient who is experiencing the satisfactions or difficulties of devices made for his help.

The third and last factor in selection and provision of equipment is the fabrication or construction of the device itself. Again, this is an area that I have already covered previously and therefore I shall not make more than a brief resume.

It is important to know something about materials and principles of construction design and to evaluate this information in terms of the tools, the time, and the personnel and skill at our disposal. While devices are becoming more and more available as more people enter the field professionally, the occupational therapist, I believe, still has a role to play, if not in construction, then in understanding so as to improve his ability to work with the team in evaluating, testing and training.

The engineer does not select or choose at random the various materials he uses, nor create a design out of idle fancy. He uses fundamental principles regarding properties of materials and laws of mathematics and physics. Even the clothing designer relies on more than just the need for a new fashion. As it was expressed to me by a well-known dress designer, a sure sense of such things as the very "feel" of a material, which suggests the "hang" and "hinge" of the weave—the pull and tension of the threads themselves—is basic to good design.

And we can make another contribution. This is to seek and find the different types of devices that will meet the needs of many different disabilities and many activities and will satisfy the various other demands of a majority of the disabled, their therapists, doctors and families. Upon such a basis, and by means of the production line, manufacturers will eliminate some of the higher costs of today's individual construction. At present, because some production is limited and prices therefore high, we have a tendency to complain that this goal is not being achieved. But we must remember that their inability to provide us with lower costs is in large part directly related to our own inability to accomplish the above and thereby come into some accord on what we want.

To appreciate fully the manufacturer's problem, let me give you a simple illustration. I asked our staff to tell me how long it would take them to make an ordinary spring-clip clothespin. Estimated time was from one-and-a-quarter to six hours. Obviously, various levels of skill are represented here and must affect the cost of labor which, if figured accordingly, would run from \$1.75 to \$6.00 for this one simple, dime-a-dozen clothespin. Manufacturing costs also are high for a single clothespin, for making the necessary jigs may take longer than to make a whole clothespin. The only answer to this lies in quantity production.

This can only be desirable, for it is also an answer to helping more patients. We must recognize and accept with standardization, however, the fact that there will always be the extreme deviations from the average or norm, which will leave us with some unanswered problems requiring special solutions. And, as with all standardization, we must never fall into the trap of believing we have found our final goal. There must remain the challenge of further improvement.

It is within this last framework of thought that I would like to call attention, before I close, to the contributions of research and special studies and the place of the occupational therapist in these endeavors. When I, as an occupational therapist, entered the field of self-help devices, there were no specific boundaries or limitations as to who should be doing this work or how it was to be done. With time, we are lending direction to how it should be done and, to a certain extent, by whom. The role of the occupational therapist is being defined. It seems necessary, as we shift from the unique to the standard, to fit into the pattern and scheme of organization and teamwork.

Nevertheless, when one problem or set of problems has been solved, automatically new goals are set, new needs discovered. I like to recall the words of Robert Browning,<sup>4</sup>

"Ah, but a man's reach should exceed his grasp,  
Or what's a heaven for?"

For occupational therapists looking for new worlds to conquer, there is always one waiting at our finger tips. And while we may not recognize at first where the path lies, if we seek we shall find it.

At a time when there came a deeper recognition of the need for stepped-up development and use of self-help or assistive devices, occupational therapists along with others made available their talents and skill to help find the answers. And out of all these efforts there has been achieved a beginning science of this new field. We recognize that we have certain techniques at our disposal: (1) the study of motion requirements for specific activities and how these relate to the possibilities of the total functioning of an individual and to limited function; (2) the understanding of the patient's psychological needs and ways of meeting them and (3) the understanding of mechanical requirements through study of materials and fabrication processes. And, finally, we can come to determine how and where our contributions as occupational therapists will serve most potently in the total process. Most probably it will be in testing for selection of devices, check out for use, and training. Sometimes, depending upon need and suitability, occupational therapists' skill may be used in fabrication.

In conclusion, we have met our responsibility to the patient who needs devices by lending our resources to this field. We must continue to meet these responsibilities so long as there remains a need for our skills. And finally, we must remain eager to participate in any way where the vision of others or our own vision can create a better world for the disabled.

## References

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