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Artificial Limbs

*A Review of
Current Developments*

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RESEARCH AND DEVELOPMENT

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Whither Prosthetics and Orthotics?

GEORGE T. AITKEN, M.D.¹

THE publicity concerning scientific and technical advances keeps us constantly aware of man's increasing competence to master his environment. The technologies available make possible a wide variety of mechanisms that expand man's sphere of activity and make possible comfortable living in environments previously considered undesirable. Some of the modern techniques, when applied in the biological fields, have eliminated some diseases, controlled others, and have made possible medical and surgical procedures that extend the life expectancy of persons of all ages. Continuing research undoubtedly is going to demonstrate eventually the etiological factors in other disease entities and thus permit the development of a nonsymptomatic approach to therapy.

Many of the current scientific advances have been the result of interdisciplinary effort, where two or more separate disciplines have worked together, hopefully synergistically. This interdisciplinary effort in prosthetics and orthotics has produced what is often described as a bioengineering effort. In the past twenty years increasing emphasis has been placed on the engineering aspects of this specific problem. These years have witnessed a rapid advance in the development of new industrial materials and hardware that have been readily applicable to artificial limbs and braces. Many improvements in previous fabrication techniques and components were facilitated by using these newly available industrial developments, and thus some advances were made in upgrading the quality of prosthetic and orthotic devices.

There have been varying degrees of concurrent fundamental research in the biological aspects of this interdisciplinary approach.

It seems at times, though, that the glamour of technology has overshadowed the purely biological problems. Research activities involving these glamour areas have been more attractive to many, and funds for such research have been more available in these sometimes esoteric areas.

At times it would seem that many involved in prosthetics and orthotics

¹Chairman, Committee on Prosthetics Research and Development, July 1, 1962-June 30, 1965. Upon completion of his term as Chairman of CPRD, Dr. Aitken will continue to serve as a member of CPRD.

research and development have failed to see the entire problem. Basically, it is the problem of achieving the optimum man-machine interface. The ultimate resolution of the problem is the production of designs that result in comfort, maximum function, and reasonable cosmetic restoration.

There is little question that much has been accomplished. Certainly we have available currently biological and engineering techniques that are capable, in a high percentage of cases, of producing improved function and cosmesis. Continuing intelligent modification of techniques and components produces more and more improvement in all of these areas. It is fair to assume that amputees and others with orthopaedic impairments are now better served than ever before.

Unfortunately, many in the field of prosthetics and orthotics research and development seem to have a tendency to relegate the patient to a secondary position. They appear to be bent on the perfection of the machine without due consideration to the education or alteration, or both, of the man to perfect the interface.

It seems timely to give consideration to some of the areas in which continuing, accelerated investigation is desirable.

Research in amputation surgery to provide more functional stumps and consequently more comfort to the patient has been significantly lacking. There is a multiplicity of amputation techniques. Myoplastic and osteoplastic techniques either alone or in combination have been recommended to promote comfort and improved function. In this country there has been no well-organized clinical evaluation of these claims made primarily from abroad. It seems logical that such procedures be investigated and evaluated thoroughly. There are good theoretical reasons to justify consideration of these procedures so that they not be simply rejected because of dissimilar training and experience.

Cineplastic procedures were critically investigated, and well-established criteria have been developed for their use. A similar review should be made of some of the other surgical problems.

The immediate postsurgical fitting of sockets with or without early weight-bearing currently is being investigated. Undoubtedly, the results of this well-organized investigation will develop proper indications and techniques for this procedure. Hopefully, such techniques will be of positive value in influencing the man aspect of the man-machine interface.

There are in addition many areas of basic biological research that need further investigation. The problem of biological signal sources for control of external power comes to mind immediately. Other, perhaps less exotic, problems, such as analysis of joint motions to permit more satisfactory alignment and construction of braces, or the metabolic problems incident to amputation and use of prostheses as well as analogous problems in the orthotics field, need further investigation. These are but a few of the many fundamental problems that need clarification.