INTRODUCTION

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The many contributions of our VA Prosthetics Center staff have usually been recorded in the body of this report. With this tenth (or fifth anniversary) issue of the Bulletin of Prosthetics Research we offer a slightly different format. Selected contributions made by the staff are now featured at the beginning of each semiannual report.

When progress on a particular project bears special significance, that portion of our report will appear separately under the “Features” section of the report. In the present issue for example, the article on measurement of pressures applied to the lower extremity deals with achievements which now should be highlighted by such treatment. Its significance is in the forward steps toward objectivity being taken in studying the interface between stumps or limbs and the appliances we put on them. More and more of this type of research has long been needed; the use of the pressure transducer mentioned in this article will eventually yield information we can use for developments of some significance.

The concept of the “instant laboratory” has been devised to give the clinical researcher tools for gathering objective data. This discussion also has been treated at the beginning of this report to encourage research-oriented clinicians to consider this possibility for research support rather than the sometimes aggravating route of grant or contract application.

There has been steady progress on the development of the standard skeletal prostheses for the lower extremity. We believe that the below-knee standard prosthesis will gradually be used by more and more fitters. Employment of the skeletal structure with capability for alignment adjustment will yield significant benefits in amputee service. With the socket produced from POLYSAR\(^a\) synthetic rubber supplied by Polysar, Inc., a prosthesis reasonably adjustable both in fit and alignment is now becoming available. It can be used from the time of the first cast change in immediate postsurgical prosthetics fitting, up to and including the definitive pros-

\(^a\)Registered trademark of Polymer Corporation Limited.
thesis. As a matter of fact some researchers feel that Polysar synthetic rubber can eventually be used for the first dressing.

One of the most interesting aspects of the adjustable standard prostheses is the improved service that can accrue to amputees. Readjustment of fit and alignment will never be too rigorous; an amputee, six months to a year after fitting of a prosthesis, might very well be scheduled for a routine check-up. Adjustments can be made to the prosthesis to suit changes that might have occurred in the stump or in the progress of the amputee in control of his prosthesis. Normally this would require complete reconstruction. In the case of the adjustable prosthesis, minor refitting and realignment are relatively simple, possibly performed right in the clinic.

Similarly, the above-knee standard prosthesis will permit facile interchange of knee controls, first, at the time of prescription and then later as progress is made by the amputee. We have hopes that the Polysar synthetic rubber can be used for above-knee sockets as well, again to achieve some degree of total adjustability in a simplified way.

Also contained in this report are developments associated with what we call "hybrid" upper-extremity prostheses. A lot of attention has formerly been focused on the problems of the high bilateral for whom external power is necessarily the only solution. However, functional needs of the unilateral above-elbow amputee might in some cases be accommodated by selective use of external power.

In considering clinical application of externally powered systems, one should aspire, at least at first, to the simplest of changes in prosthetics practice. Thus, if everything else remains the same in the prosthetics fitting and a mechanically powered component can be readily replaced by an externally powered one without major changes in other portions of the appliance, then some degree of simplicity has resulted.

Many of the functions which might be powered have been considered. Some people feel that powering an elbow in an otherwise conventional above-elbow prosthesis would be a starting point for a simple functional improvement with a minimum of change in the fitting and alignment process. Thus, a powered elbow with size and shape like the conventional elbow would be desired. A control system which is not that new to an amputee nor difficult to install and adjust would be indicated, at least for the beginning.

In this way, some unilateral above-elbow amputees might benefit significantly. The reduction in the amount of body motion for prosthetics control will be advantageous. Preferably the system should otherwise require the same kinds of controls now employed. Thus we have developed the approach outlined in this progress report, hoping first to substitute a powered elbow and then, perhaps later, powered wrist rotation. If we can take a few steps to improve function, some prostheses may come out
of the closets and many amputees who now obtain only restricted use of their artificial limbs may benefit. But more significantly, the way will be paved among clinicians and prosthetics practitioners alike for the introduction of powered systems where the needs are greater, as in the high bilateral upper-extremity amputee.

I. FEATURES
   A. Measurement of Pressures Applied to the Lower Extremity
   B. “Instant Laboratory”

II. LOWER-EXTREMITY PROSTHETICS
   A. Basic Studies
      1. Gait Patterns of the Aged
      2. Sources for Control of Prosthetic Knee Function
   B. Development (Components)
      1. Adjustable Below-Knee Standard Prosthesis
      2. Adjustable Standard Above-Knee (Multiplex) Prosthesis
      3. Torque Absorber (Rotation)
      4. Standardization of Prosthetic Feet
   C. Development (Techniques)
      Direct Forming of Lower-Extremity Sockets
   D. Evaluation (Components)
      Modified Henschke-Mauch Model “A” HYDRAULIK System
   E. Evaluation (Techniques)
      None

III. UPPER-EXTREMITY PROSTHETICS
   A. Development
      VAPC “Hybrid” Above-Elbow Prosthesis
   B. Evaluation (Components)
      1. Gilmatic Electric Elbow Lock
      2. Rimjet Mechanical Elbow Rotator
      3. Externally Powered Hands
      4. Robin-Aids Voluntary Opening Hand
   C. Evaluation (Techniques)
      Direct Forming of Below-Elbow Sockets

IV. LOWER-EXTREMITY ORTHOTICS
   A. Development
      1. Formo-Ped Ortho-Inlay Shoes
      2. AZTRAN
   B. Evaluation (Components)
      Swedish Knee Support
   C. Evaluation (Techniques)
      None
V. ORTHOPEDIC AIDS
   A. Development
      None
   B. Evaluation (Components)
      1. Upper-Extremity Appliances
      2. Evaluation of Howmet Wheelchair (New Yorker)
      3. Evaluation of Howmet Lightweight Wheelchair (New Yorker)
      4. Revised Model Power Aid
      5. Motorette Wheelchair Power Unit
      6. Design Analysis of Several Orthopedic Aids
      7. Dierker Experimental Folding Crutch
      8. Wheelchair Pads
   C. Evaluation (Techniques)
      None

VI. TESTING
   A. Standards Development Program
      1. Stump Socks
      2. Specification Check and Preliminary Evaluation of Typhlocane
   B. Compliance Testing
      1. Stump Socks
      2. Upper-Extremity Components
      3. Lumbo-Sacral Corset Material

VII. OPERATIONS REPORT FOR FISCAL YEAR 1968
   A. The Orthopedic Shoe Service
   B. The Prosthetics-Orthotics Service
   C. The Restorations Service
   D. Special Clinic Team

REPORT
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This report details the progress and status of research and development conducted in various laboratories and services of the VA Prosthetics Center. It was compiled with the assistance of Donald W. Wright, Research Physiologist. A change has been made in the format and style of the report. Significant articles will be featured at the beginning of each semiannual report. In general, two kinds of articles will be featured—those of broad, general interest and complete reports or articles on important research or development projects.

The remainder of the semiannual report will continue to carry the details of our work as before.