HIGHLIGHTS OF VA CONTRACTUAL RESEARCH PROGRAM

PROSTHETICS

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Using dogs as subjects, research has continued on the attachment of an external prosthesis and plugging the amputated bone to increase end-bearing tolerance.

On four new dogs, it is planned to insert Teflon mushroom-shaped plugs into the tibia for end-bearing. This had been done previously with a dog who is still alive, four years after surgery was performed. The new plugs will be altered in design so that the end will be larger in diameter to cover the entire bone end, and the radius will be larger, presenting a broader, flatter surface. The Teflon plugs are currently being fabricated in multiple sizes at the General Motors Technical Center.

After the plugs have been in place for 6 weeks, a hip sling will be applied to the opposite leg to allow the dog to walk only on the amputated hind leg and the two forepaws. When it is demonstrated that this can be done, the other hind leg will be disarticulated at the hip so that full weight will be borne on the opposite leg. It is hoped that with at least two of the dogs, it will be possible to insert Dacron semi-buried mesh tabs in the thigh to harness the end-bearing external prosthesis.

Gilmatic, Northridge, California
Gilbert M. Motis

Work continued during this period on the development of upper-extremity prosthetic components. A mockup arm with three inde-

pendent motions was turned over to UCLA for tests in conjunction with development of strain-gage controllers.

Mauch Laboratories, Inc., Dayton, Ohio
Hans A. Mauch

The clinical application study of the "HYDRAULIK" Swing and Stance Control System Model A continued during this period. Visits were made by Mr. Mauch and Mr. Earl A. Lewis of the Research and Development Division staff to several VA clinic teams participating in the study.

Work continued on the development of a hydraulic ankle control unit. A number of design and component changes have been made with a view toward improved performance. The unit is being tested by a local amputee.

A brief (5 minute) color film on the functions of the hydraulic ankle has been prepared. Foot and ankle actions on level and rough ground and on stairs and ramps are depicted with the intact human leg and with conventional and hydraulic prostheses.

Initial experiments to obtain a signal for prosthetic control by reflecting ultrasonic energy from a muscle had encouraging results.

National Academy of Sciences-National Research Council
Washington, D.C.

The varied activities of the Committees on Prosthetics Research and Development and Prosthetic-Orthotic Education were continued during this period. Several panel meetings and workshops were held. The Committee on Prosthetic-Orthotic Education held its annual meeting in New York on April 27, 1967.

A meeting of the Subcommittee on Sensory Aids was held in Washington on March 30–31, 1967. The members and a group of invited guests from many government and private agencies and universities discussed research, evaluation, and deployment of new aids for the blind.

New York University, New York
Renato Contini

Work continued on pressure measurement. During this period the sockets for three of the subjects have been completed. To date, one of these subjects has been tested on seven separate occasions. These tests have produced data for several complete mappings of stump pressures; in addition, data have been collected on additional tests which are

outlined below. Tests on the other two subjects are at the preliminary stage.

Changes in alignment which have been introduced on one subject's test prosthesis have affected the magnitudes of dynamic pressure, particularly those in the posterior and medial regions of the brim.

Changes in the magnitudes of dynamic pressure can also be attributed to the fact that the amputee probably fits and aligns his prosthesis differently each day. Thus he may pull his stump further into the socket on one day than on another or, he may have more toe-out or toe-in from one day to the next. It should be noted that these changes neither cause discomfort nor do they affect his gait to any great extent.

Two of the subjects have each been tested on several occasions to determine the extent and frequency of these changes by having them don and remove their test prostheses four or five times during a series of tests. The changes in the fit and alignment of the socket relative to the stump are noted by marking the locations and several transducer sites on the stump and then measuring the shifts in position.

The VA multiplex pylon has been substituted for the Hosmer alignment pylon on one subject's prosthesis to determine whether hydraulic control affects the socket pressure patterns in any way. A preliminary check of the data indicates that there is no noticeable change. A second subject is being fitted with this pylon to confirm these results.

Northwestern University, Chicago, Illinois
Clinton L. Compere, M.D.

Elsewhere in this issue of the Bulletin is a report on the Northwestern University power unit for the upper-extremity amputee. The project plans to continue its evaluation of this unit to determine its full usefulness and range of application. Also to be studied will be its application to hand orthoses.

Preliminary studies of EMG signal processing methods have been completed. These studies were undertaken to determine how proportional control of external power devices could best be achieved using EMG signals. The results indicated that in this application the autogenic backlash unit proposed by Bottomley is superior to other smoothing methods.

Work is continuing on motor speed control methods by pulsed current techniques. It is felt that some of the objections to this approach may be overcome with proper circuit design.

Further work has been done on above-knee pneumatic sockets. One above-knee amputee is wearing a socket with the air bag located on the medial wall. From use and trial inflations the inner plastic cover-

ing has become permanently stretched which is especially noticeable where the bag seam is located. Larger bags are being tested with finer seams with which it is expected to be able to isolate the seams from the inflated area and simultaneously control volume with a finer and more gradual transition.

A second above-knee amputee has been fitted with the inflatable bag in the lateral wall of the socket. Early wearing did not necessitate volume adjustment. Following stump shrinkage however, the pneumatic bag was partially inflated which decreased the ischial load and afforded better control of the prosthesis.

Additional amputees will be fitted with the larger air bags placed in different areas to determine the optimum position.

University of California at Los Angeles
Biotechnology Laboratory
John Lyman, Ph. D.

The report by UCLA on the evaluation of the AIPR pneumatic prosthesis is presented in this issue of the Bulletin.

The preliminary experimentation with an "in harness" electrical strain gage transducer using a non-amputee subject has produced promising results. The subject was able to operate a 3-site harness control system which involved simultaneous excursions of shoulder flexion, shoulder extension, and shoulder elevation. Only small forces and slight excursions compared with body control are needed.

In order to explore further such harnessing techniques a bilateral amputee has been selected and fitted with a socket on his right above-elbow stump, using a conventional figure-8 harness for support. Investigation is now underway to select transducer harness locations for 3-dimensional control systems. Both conventional and new site locations will be studied for this purpose. These locations will be tested for signal-to-noise ratio, maximum velocity and amplitude, fatigue, rate and position control ability, and isolation. The strain gages, of course, unlike EMG controls, avoid the risk of electrical interferences from fluorescent and neon lights, other stray fields, and the patient's own electrocardiographic signals.

Based on the test results, the best transducer sites will be chosen for 3-site harness control system.

Work has been temporarily suspended on the exploration of minor surgical methods for developing new body control sites.

University of California at San Francisco and Berkeley
Charles W. Radcliffe [a] and Howard D. Eberhart

Several design changes have been made on the UC-BL pneumatic swing-control unit. An aluminium piston has been substituted for the nylon one and has eliminated problems of thermal differential expansion and has also permitted the use of low friction U-cup-type piston seals. The piston rod and rod end have been redesigned to simplify fabrication and eliminate the adjustable threaded coupling which allowed errors to occur in the overall extended length of the unit. Length and dimensions of the end bearing have been adjusted slightly to match those of the Dupaco hydraulic swing control unit. It is anticipated that the Veterans Administration will undertake a clinical application study of this pneumatic system.

Work continued on the development of a UC-BL pylon-type above-knee prosthesis with a single-axis knee joint. This multipurpose knee/shank assembly is intended to accommodate pneumatic or hydraulic swing-phase control devices for use in the construction of pylon-type prostheses for above-knee amputees and for knee-disarticulation cases. Thin-walled aluminum castings were chosen for knee block and shank because of their precision, strength, and light weight. The shank unit was designed so that it could also be used with the existing wood knee block now being employed for the evaluation of the pneumatic swing-control unit. For the above-knee prosthesis it is planned to develop a combined foam and metal knee block and thus eliminate all wood from the prosthesis.

On a low priority basis, work has continued on resolution of prosthetic problems associated with through-knee amputations. The primary problem is the bulk of the prosthetic side joints, which, for proper function, must be placed adjacent to the widest part of the stump. Two designs without side joints are currently under study to determine whether it is feasible to produce a simple prosthesis without side joints, and with a pneumatic swing-control unit.

No practical design has as yet been developed for a spherical-linkage type of a constrained-motion hip joint for use in a long leg brace for patients with pathological conditions of the hip.

Biomechanical studies of the lower extremity have continued at this project. The ultimate aim is to provide a comprehensive picture of the biomechanical roles of all body segments in normal human locomotion. The specific aim is the analysis of motion at the principal joints of the lower extremity.

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[a] Prof. Radcliffe is presently on sabbatical leave at the University of Strathclyde, Glasgow, Scotland, where he is concerned with the organization of new bioengineering research programs.

VA Hospital, Seattle, Washington
Ernest M. Burgess, M.D.

To date some 150 cases have been managed by the Seattle Prosthetics Research group, using immediate postsurgical prosthetics techniques. Considerable efforts have been expended to disseminate the procedures involved to interested clinicians. The three universities offering prosthetics educational programs will offer courses in immediate postsurgical prosthetics during the next academic year. These courses will be limited to physicians and prosthetists, with prerequisite training in lower-extremity prosthetics.

A manual entitled "Immediate Postsurgical Prosthetics in the Management of Lower Extremity Amputees" has been prepared by Dr. Ernest M. Burgess, Mr. Joseph E. Traub, and Mr. A. Bennett Wilson, Jr. and may be purchased from the Government Printing Office. This publication describes surgical and prosthetics procedures used primarily by the Seattle project for the various levels of lower-extremity amputations. Included are special instructions for nursing, ambulation, and training. Sources of supply for necessary components are given.

SENSORY AIDS

Howard Freiberger, A.M.

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Fabrication of Obstacle Detectors for the Blind

Bionic Instruments, Inc., Bala Cynwyd, Pennsylvania 19004
Thomas A. Benham, J. Malvern Benjamin, Jr.,
D. Ridgeley Bolgiano, and E. Donnell Meeks, Jr.

The model C–3 laser typhlocane, Figure 1, mentioned in BPR 10–6 was completed in December 1966 and then demonstrated before several groups interested in mobility for the blind. The reactions to the cane were obtained from knowledgeable people, including blind individuals, at some eight different locations.

Based on experience with the Model C–3 cane, the developers are building a Model C–4 which will embody some new features and redesign of a number of details. Use of magnesium and possibly boron-reinforced plastic laminate should make the weight of the C–4 less than that of the C–3 and well under 2 lb. The center of gravity will be shifted toward the upper end. A joint between upper and lower sections will permit quick-disconnect action yet provide the rigidity