HIGHLIGHTS OF VA CONTRACTUAL RESEARCH PROGRAM

PROSTHETICS

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This project has continued its research on dogs on the attachment of an external prosthesis by semiburied attachment and of plugging the amputated bone to increase end-weight-bearing tolerance.

Vitallium mesh implants, either heat-fused by the General Motors research laboratory or coated with Teflon, seem to be clinically promising. The tissue around this mesh often does not seem to be inflamed and the mesh is not extruded. Some of the mesh inserts have been in place successfully for two to three years.

Dr. Esslinger is also encouraged by success with dogs in plugging the end of the bone in order to promote end-weight-bearing on closed skin, in areas which would not normally be considered suitable for end-weight-bearing.

Gilmatic, Northridge, California
Gilbert M. Motis

A bench model of an electrical elbow lock and lift prototype was developed and is being tested at the UCLA project.

Three Hosmer elbows have been modified for electrical control by solenoids as well as three pressure switches to be operated by muscle bulging. To afford an alternative method for briefly energizing a lock, three pull switches have been developed. Either the bulge or the pull switch would be cut off to save power, after a brief pulse to the solenoid. One of the three elbow locks will be fitted to an amputee in the Los Angeles area and the other two will be tried at the VA Prosthetics Center in New York.

One model of a mechanical wrist rotator has been completed. It is possible that with a biceps-bulge-controlled elbow lock, the usual strap anterior to the shoulder which conventionally controls the elbow lock, might become available to control the mechanical rotator. There is also the long-recognized possibility of coupling the wrist rotator to elbow flexion for coordinated motion.

A mockup has been made of an electrical wrist rotator with a motor close to the elbow (to reduce moment from the motor weight), a self-locking worm gear drive, and provision for cable axial control around a diametrically oriented pin. It is expected that this wrist would deliver reasonable torques.

An electrical "prepositioning" rotator has been built with much less reduction gearing, using a single-tooth pinion which moves one gear tooth for each pinion rotation. A cam on the pinion shaft pushes a locking tooth out of the opposite side of the gear just as the pinion engages, but releases the spring-loaded tooth to reengage the gear just as the single pinion tooth leaves contact.

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

Fifty "HYDRAULIK" Swing and Stance Control Systems, Model A, were produced and delivered to the VA Prosthetics Center. A clinical application study of the Model A has been initiated by the Research and Development Division of the Prosthetic and Sensory Aids Service, involving 40 above-knee amputees who will be fitted with the Mauch A. Ten VA clinic teams, working with commercial prosthetists in their areas, are cooperating in this study.

Vigorous efforts have been made by this project to complete the development of a hydraulic ankle control unit. Several solutions to provide adjustable toe-pickup are being investigated. The ankle will not only block against dorsiflexion, but will provide controlled lateral motion and controlled transverse rotation about the longitudinal axis of the shank, the last a long-sought goal of the artificial limb research program.

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

A report of the activities of the Committee on Prosthetics Research and Development for the year ended June 30, 1966, is published elsewhere in this issue.

The 16th meeting of the committee was held in Washington, D.C., on October 13–14, 1966.

New York University, New York
Renato Contini

Pressure measurement studies continued to be the major area of investigation. Preliminary tests of two of the subjects have been completed. During these tests the subject's gait is evaluated and minor adjustments in alignment are made. Amplifier attenuator settings for the various transducer/pressure site combinations are also determined. These settings will be maintained during the regular tests which follow so that direct comparisons of oscillograph records may be made without recourse to data reduction.

To date, one of the above-mentioned subjects has been tested on five separate occasions. As a result of these tests, ten complete mappings of pressure have been recorded, including day-to-day pressure variations and the sensitivity variations one can expect if several transducers are used at the same site.

Special sockets for three of the subjects are in various stages of completion and tests of these subjects will be initiated during the next quarter.

Temporal factors will be recorded by means of strip switches (manufactured by Tapeswitch Corporation of America) cemented in the slotted soles of the subjects' shoes. In addition to variations in cadence, the various portions of stance phase will be recorded.

Besides these pressure measurement studies, the project continued to gather data on the maintenance experience of 12 wearers of the Henschke-Mauch "HYDRAULIK" Model A, Swing and Stance Control System.

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

A report on the Northwestern University suspension casting technique for below-knee amputees will be found in this issue of the Bulletin.

A 27-minute color movie has been produced on Bilateral Hip Disarticulation Prosthetics. This film may be borrowed from the Research and Development Division of the Prosthetic and Sensory Aids Service in New York.

An electric power assist unit has been completely redesigned to eliminate the problem of limited excursion. This Model II has a belt driven power nut/screw instead of a direct drive as on the previous model. The first unit of Model II has been fitted to an 18-year-old male forequarter amputee. The complete unit, including battery, is mounted within the humeral section. A switch is mounted on the chest strap to control elbow flexion and the terminal device. A nudge switch controls elbow extension. The power unit, battery, and switches increase the weight of the prosthesis from 4.7 to 5.6 lb.

The below-knee immediate postoperative fitting program continues actively, with extension to above-knee and Syme amputations.

Work continues on development of above-knee pneumatic sockets. One amputee is wearing a prosthesis with an inflatable bag in the lateral wall of the socket. Observations indicate that there must be a smooth junction between the distal end of the inflatable area and the socket wall. The bag must be placed approximately 1 in. proximal to the distal end of the femur. The proximal aspect of the bag should terminate distal to the trochanter.

The subject wearing the test socket experienced pinching in the proximal medial portion of the socket when sitting and driving his car. Relief was obtained on release of the air.

Further studies are necessary to determine the optimal positions of the inflatable areas to accommodate shrinkage of the stump and for stabilization of the femur.

X-rays taken of the stump while in the socket showed definite support on the lateral aspect of the femur with the bag placed laterally and with resultant relief on the proximal medial aspect of the socket.

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

The UCLA reports on the Northwestern University attitudinally controlled elbow and on the French electric hand will be found elsewhere in this issue.

Work continued on the exploration of minor surgical methods for developing new body control sites.

Further developments of an "in harness" electrical strain gage transducer have been carried on using half-inch Dacron straps as harness material. The basic procedure is to attach an SR–4 type strain gage directly on the Dacron strap reinforced by an aluminum backing plate, and encapsulated in silicone rubber. Three transducer models of this construction have been produced and are now being used as an integral part of a control harness which is presently under experimentation.

A bench model of an electrical elbow lock and lift prototype, developed by Gilmatic, is being studied at this project. A preliminary investigation of the output characteristics has been made, and a control logic system will be constructed. Transducers and harnessing of the type described above will be used for the initial experiments.

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

An integrated series of reports and manuals is being prepared on lower-extremity bracing and shoe inserts, based on years of research for many sponsors including the Veterans Administration. Publication in a single journal would be desirable. These reports will cover concepts of orthotics prescriptions and biomechanics of the foot and ankle (both of broad applicability), as well as philosophy of the dual-axis ankle brace plus detailed methods for fitting and aligning that brace and the shoe insert. In the present design, the brace is suitable for mild forces capable of controlling plantar flexion and dorsiflexion and lateral motion about the subtalar axis during swing phase. Thus, in certain conditions, the foot can clear the ground adequately to prevent stumbling and can make heel contact in a favorable position. The shoe insert, in turn, is intended to support the foot in the correct position during stance phase. Either element can be prescribed independently, or both may be useful for selected cases, but neither is a panacea.

These external analog "braces" also are needed to support recording equipment at the pelvis and shoe for fundamental studies of motions at the knee joint. Some experiments have already been made, but the hip joint is not practical for the high forces needed for some applications of hip braces. The computer programs for reducing data are already prepared.

Work continues on studies of the kinematics of the hip and knee in relation to bracing and artificial limbs. In addition to contributing to basic kinematic theory, presented at the Mechanisms Conference sponsored by the American Society of Mechanical Engineers in October 1966, the UC group has attempted to relate body motions to bony landmarks and dimensions.

The specifications and drawings for the UC pneumatic control for swing phase of above-knee prostheses are being completed to allow procurement, probably for an extensive clinical application study. Every effort is being made to allow direct interchangeability with the Dupaco hydraulic control in wooden shanks and knee blocks. There has been excellent experience with test models of the UC pneumatic knee, wooden knee block, and special metal pylon-type shank with foam cosmetic covering.

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

A report is published elsewhere in this issue on the activities of this project during the period July 1, 1965–June 30, 1966. To date, more than

[a]Prof. Radcliffe, who is on sabbatical leave this year, is at the University of Strathclyde, Glasgow, Scotland.

100 cases have been managed by the Seattle group, using the immediate postsurgical prosthetic fitting technique.

Project personnel continued to devote considerable time on educational efforts for clinicians interested in the technique.