

## REPORT ON THE COMMITTEE ON PROSTHETICS RESEARCH AND DEVELOPMENT

### EVALUATION OF DIRECT FORMING OF BELOW-KNEE SOCKETS

Even before the introduction of laminated plastic sockets, prosthetists have recognized the desirability of having a material which could be formed over the stump at a temperature low enough not to be painful and with sufficient strength to withstand the loads generally imposed on sockets. The availability of such a material might make it possible to eliminate the need for a male plaster-of-paris model and the messy conditions inevitable in its preparation. At the same time research groups have been continuously trying to develop cast-taking techniques that yield uniform, useful results and require a minimum amount of skill.

A group at the Veterans Administration Prosthetics Center, led by Henry Gardner, have developed a process which eliminates the need for the male model and also reduces the amount of skill required to achieve uniform results, by forming a synthetic balata tube directly over the stump by means of an air-filled sleeve. Total contact is achieved by introduction of a foam-in-place Silastic compound. In addition to the reduction in time and skill required to fabricate the socket, other advantages claimed by the developers are the ease with which modifications can be made to the finished socket and the "feel" of the synthetic balata to the skin.

The CPRD, under the terms of Contract No. SRS 69-9 with the Social and Rehabilitation Service, has agreed to carry out a clinical evaluation of the new technique. Clinics at the University of Miami, Duke University, Rancho Los Amigos Hospital, Veterans Administration Sawtelle Hospital, and the VA Regional Office, Syracuse, N.Y., were invited to participate. Prosthetists associated with these centers were trained in the technique November 6-8, 1968, at the Veterans Administration Prosthetics Center and asked to fit 10 patients, five new and five satisfied PTB wearers, and to keep accurate records of the results.

The synthetic balata sockets will be tested for usefulness both as an interim prosthesis and as a definitive or "permanent" prosthesis. Time studies of the new fabrication method and of conventional lamination methods will be made. Results concerning use as an interim prosthesis will be published as soon as conclusions can be drawn and will not be delayed until results can be obtained on use for long periods as a definitive prosthesis.

### CPRD MEETING

The 19th meeting of the Committee on Prosthetics Research and Development was held in Washington, D.C., October 29, 1968.

Mr. Anthony Staros, the newly appointed Chairman of the Subcommittee on Design and Development, reported on meetings of the Panel on Upper-Extremity Components and the Panel on Lower-Extremity Prosthetics Fitting and stated that during the remainder of the fiscal year the following meetings were scheduled to be held under the auspices of the Subcommittee:

Symposium on Below-Knee Prosthetics

Workshop on Knee-Disarticulation Prostheses

Workshop on Hip-Disarticulation Prostheses

Workshop on Orthotic Knee Joints

Workshop on Fracture Bracing

Workshop on Braces for Spina Bifida Cases

Workshop on Braces for Cerebral Palsy Cases

Medical Orientation for Research Prosthetists, Orthotists, and Engineers

Mr. Howard Thranhardt, Chairman of the Subcommittee on Evaluation, stated that the clinical evaluation of the Engen Plastic Hand Orthosis and the Veterans Administration Prosthetics Center Patellar-Tendon-Bearing Brace, started as part of the pilot program in evaluation, was nearly completed and that reports would be forthcoming shortly. Plans were being made for the immediate initiation of a clinical evaluation program for below-knee sockets formed from synthetic balata directly over the stump by application of pneumatic pressure as developed at the VA Prosthetics Center. Mr. Thranhardt also reported that every effort is being made to coordinate as closely as possible the activities of the Evaluation Subcommittee with the Education Program in order to accelerate effective introduction of new devices to the field.

Mr. Colin McLaurin, in reporting the activities carried out by the Subcommittee on Child Prosthetics Problems in the absence of the Chairman, Dr. George T. Aitken, noted that there are 28 child amputee clinics participating in the program and others are being considered. It is estimated that the 28 clinics participating now serve 65 percent of the population. He reemphasized the need for specialized fitting centers to serve the severely handicapped child amputee.

Dr. Arthur Lesser of the Children's Bureau stated that the Bureau was in accord with this recommendation but with the budgetary limitations in effect no new centers could be started immediately. However, he felt that the activities of some existing centers might be expanded in

the near future to undertake some of the work that had been proposed at the previous meeting of CPRD.

There was a general discussion on fundamental research that indicated a need for stimulation of basic studies concerning the function of the spine. It was recommended that a workshop on the spine be held during the year.

The meeting was concluded by a roundtable discussion of improving further the introduction of results of research to clinical practice.

### **PANEL ON UPPER-EXTREMITY PROSTHETICS**

Because of the tendency of the Panel on Upper-Extremity Prosthetics Fitting and the Panel on Upper-Extremity Prosthetics Components to overlap in interest, the two groups have been merged into a single entity known simply as the Panel on Upper-Extremity Prosthetics Components. The chairman is Dr. Edward Peizer, Chief, Bioengineering Research Service of the Veterans Administration Prosthetics Center.

The new group held its first Workshop October 21-25, 1968, in Santa Monica, Calif. The first day was devoted to the study of externally powered elbow systems and in the subsequent 2 days virtually all other matters of interest in the development of improved upper-extremity prosthetics were considered.

To gather together as much useful information as possible arrangements were made to have patients at the meeting who had been fitted with elbow systems. The seven systems known to be either available or well advanced in development were obtained and fitted to seven patients. The seven systems were those developed by the Army Medical Biomechanical Research Laboratory, Gilmatic, Rancho Los Amigos, Ontario Crippled Children's Centre, VA Prosthetics Center, American Institute for Prosthetic Research, and Liberty Mutual Insurance Company (Boston Arm). The units developed at Rancho Los Amigos and Gilmatic were fitted by those groups respectively. The other five were fitted on October 24 by Messrs. Rodney Chupurdia, Maurice LeBlanc, and Thomas Pirrello.

Out of the conference came the recommendation that models of the AMBRL and Gilmatic designs be procured for clinical evaluation studies. It was noted that all of the designs offered had merit and that plans for further evaluation were under way for most of the other designs.

It was also recommended that a similar workshop be conducted on externally powered terminal devices during the Spring of 1969.

### **SUBCOMMITTEE ON CHILD PROSTHETICS PROBLEMS**

On October 28, 1968, the Subcommittee on Child Prosthetics Problems met in Washington, D.C. In the absence of Dr. George T. Aitken,

Mr. Colin A. McLaurin was chairman. The various development and evaluation projects concerned with child prosthetics were reviewed and recommendations for future action were made.

The Subcommittee approved the Child Amputee Clinic, Shriners Hospital, Portland, Oregon, as a participating clinic, raising the total to 28. The Subcommittee is in contact with 16 additional clinics that are interested in becoming affiliated with the participating clinical research program.

### **MEETING OF THE SUBCOMMITTEE ON EVALUATION**

The Subcommittee on Evaluation met in Miami, Fla., December 7, 1968, to ascertain the status of various evaluation projects and make recommendations for the future.

Reports were received from the CPRD staff concerning the Engen Plastic Hand Orthosis, the VAPC Patellar-Tendon-Bearing Brace, and below-knee sockets formed of synthetic balata (Polysar<sup>a</sup> X414) directly over the stump using pneumatic pressure. Clinical evaluation of the Engen Plastic Hand Orthosis and the VAPC Brace was nearly completed. The clinical study involving the below-knee socket technique was just being initiated. The pneumatic components developed by the American Institute for Prosthetic Research will be evaluated as soon as they are ready. They were scheduled for delivery early in March 1969.

Mr. William M. Bernstock reported that the Veterans Administration clinical study involving the Henschke-Mauch Model A (Swing-and-Stance-Phase Control) was nearly completed and that a similar study of the University of California Pneumatic Swing-Control Knee Unit was to be initiated almost immediately.

Dr. Edward Peizer reported on a number of items being subjected to laboratory evaluation at Veterans Administration Prosthetics Center, including externally powered terminal devices, the Blatchford Knee, and modular lower-extremity prostheses.

Dr. Sidney Fishman reported on the New York University evaluation program involving devices and techniques for child amputees. Items under study include the electric arm developed at the Ontario Crippled Children's Centre, the electric cart developed at the Child Amputee Prosthetics Project, UCLA, the Winnipeg cable recovery unit, and synthetic balata sockets for upper-extremity amputees developed at VAPC.

The chairman stated that he had been contacted by representatives of Liberty Mutual Insurance Co. concerning evaluation of the so-called Boston Arm. Further talks were scheduled.

<sup>a</sup> Registered trademark of the Polymer Corporation, Ltd.

### SEMINAR ON ORTHOTICS

The Fifth Annual Postgraduate Seminar by the University of Miami School of Medicine in cooperation with the National Academy of Sciences, the Veterans Administration; and Jackson Memorial Hospital was held in Bal Harbour, Fla., December 9-11, 1968. The major portion of the program was devoted to orthotics but one morning was spent on reviewing the latest techniques of fitting limb prostheses immediately after surgery. The faculty consisted mostly of individuals deeply engaged in research as well as clinical practice.

The foundations for sound orthotics practice were set forth in the opening session by George T. Aitken, Newton McCollough, and Donald Pierce. Details of the latest practices in bracing the lower extremity were followed by management of patients with paralysis of the upper extremities. In both instances current research efforts were reviewed and that need for further research was emphasized.

Rationale for the design and use of the Milwaukee brace were covered thoroughly. Some aspects of rheumatoid arthritis were included.

The latest results of the experiments in treating certain long-bone fractures with orthopedic bracing to give the patient mobility and accelerate healing were reported by Vert Mooney, Augusto Sarmiento, and John Connolly.

Over 300 surgeons, physicians, therapists, orthotists, and prosthetists attended.

### SYMPOSIUM ON BELOW-KNEE PROSTHETICS

On December 16-18, 1968, the Panel on Lower-Extremity Prosthetics Fitting, CPRD, conducted a Symposium on Below-Knee Prosthetics at the Veterans Administration Prosthetics Center, New York City. Participating in the symposium were prosthetists and engineers prominent in research, education, and clinical application. The primary mission of the symposium was to review and assess current practices and results of research projects, and make recommendations to the educational programs. At the same time research currently under way was reviewed and recommendations for future work were offered.

The symposium was begun by reviewing the curriculum concerning below-knee prosthetics being offered at the University of California at Los Angeles, New York University, and Northwestern University. After this clinical experience with variations of the patellar-tendon-bearing socket, such as the air-cushion socket, the supracondylar-suprapatellar or PTS, and supracondylar (wedge) suspension method were reported, and fitting and fabrication techniques were discussed in detail. Experiences with new materials including synthetic balata, porous plastic lami-

nates, and transparent plastics were presented, and progress reports were made by those projects which are attempting to map pressure distribution over the stump.

In the general discussion that followed the formal presentations, it was the consensus that:

1. there exists a body of knowledge in below-knee prosthetics that has been developed in recent years that should be made available to practicing prosthetists and other clinicians for use in everyday practice;
2. all education programs are urged to include this material in their curricula;
3. postgraduate-type courses in these latest techniques for practicing clinic teams should be made available;
4. it is recognized that manuals and instructional materials are needed. This points out the need for a central group that would be responsible for the preparation and dissemination of technical information. Material is now developed without adequate consideration for its ultimate usefulness;
5. current research efforts in below-knee prosthetics should be continued with emphasis on the development of a truly refined theory of fitting.