

# Immediate Postsurgical Prostheses Past, Present, and Future

by JOSEPH E. TRAUB, C.P. \*

*Director, Prosthetics Research Study  
Seattle, Washington 98104*

On a sunny Sunday afternoon in June of 1963 just outside of Copenhagen, Denmark during the opening day's lectures of the Sixth International Prosthetic Course, the world of amputation surgery and rehabilitation was shaken to its very foundations by a tall distinguished surgeon from Poland. The title of his paper that afternoon was simply, "Electromyographic Studies." To be sure, the substance of this paper was a statistical analysis of his electromyographical study of approximately 200 amputation stumps. The results of these studies were in themselves very enlightening and interesting, but the conclusions and use this man had put his findings to were simply astounding. Those Americans, including the author, fortunate enough to be present for the lecture of Professor Marian A. Weiss, came away questioning their hearing senses. "Did he really say that he had amputees walking with a prosthesis on the first day following surgery?" was a common question. It was finally concluded that Professor Weiss had said just that, and that he must have been just a little crazy to make such a statement. "It is not possible for a patient to bear weight on an amputation wound so soon following surgery," was another commonly heard remark.

As the days passed, a few people, especially the Americans, began to be intrigued by the possibilities of such a concept. Maybe it could be possible to apply a prosthesis to a fresh wound on the operating table. After all, it had been possible to fit some amputees with open ulcerating stump wounds which healed quickly when total contact fitting techniques were used. Also, a French surgeon, Dr. Michael Berlemont had been treating so-called "septic" stumps with plaster casts and carefully controlled ambulation since 1957 with excellent results.

With these facts in mind, it was decided that we should attempt to get more information on the technique and possibly try his method in the United States. Mr. A. Bennett Wilson, Jr., Executive Director of the Committee on Prosthetic Research and Development, a unit within the National Academy of Sciences, contacted Dr. Weiss regarding the additional information.

Mr. Wilson learned that Dr. Weiss was scheduled to make a trip to the United States with a committee from the Polish Ministry of Health in the fall of 1963. This trip was funded by the Vocational Rehabilitation Administration which was supporting a portion of Dr. Weiss' research in Poland under a counterpart fund arrangement between the United States and Polish Governments. Although the travel schedule had already been confirmed, it was decided by both Mr. Wilson and Dr. Weiss that an attempt should be made to have Dr. Weiss visit some of the larger prosthetic research centers in this country.

\* In July, 1967, Mr. Traub assumes office as Consultant on Prosthetics and Orthotics, Vocational Rehabilitation Administration, Washington, D.C.

Upon his return to the United States, Mr. Wilson contacted the Vocational Rehabilitation Administration and with their complete cooperation, arranged for Dr. Weiss to visit the Biomechanics Laboratory of the University of California at San Francisco, among others in October of 1963.

Following this visit it still wasn't completely clear to the U.S. experts as to just what Dr. Weiss' routine for immediate postsurgical fitting was. This lack of clarity was no doubt due to a slight difficulty Dr. Weiss had expressing himself in English. However, he had made enough of an impression on the experts at U.C. for them to want to try his technique as they understood it.

Accordingly in January of 1964, two below knee amputations were done by the U.C. surgeons with plaster of Paris sockets applied over newly amputated stumps in the operating room. These casts were applied by a Danish Research Prosthetist, Mr. Erik Lyquist, who was at that time on a research fellowship at the Biomechanics Laboratory of the University of California.

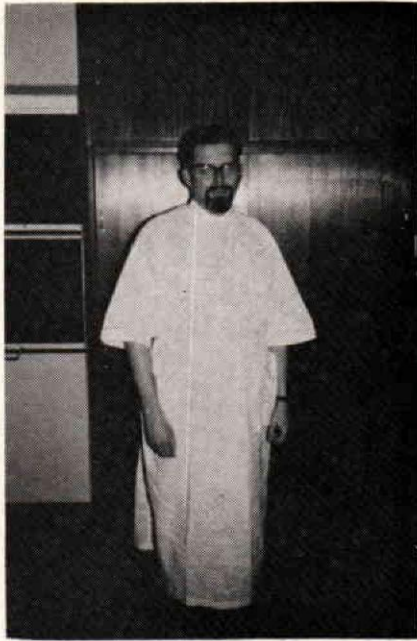
It was the author's privilege, together with Mr. Wilson, Mr. Anthony Staros, Director of the Veterans Administration Prosthetic Center, and Mr. Henry Gardner, Assistant to the Director, VAPC, to be present at the time of the second cast change on the second amputee which took place on the 13th day following surgery, the patient having been ambulatory from the first post-operative day. The appearance of the stump shape and wound healing when the cast was removed was spectacular, to say the least. The patient had experienced very little post-operative pain, and had progressed extremely well in his ambulation. Although we did not have an opportunity to see the other patient, we were told that the result with him was just as spectacular, and that he had been fitted with a permanent type PTB prosthesis on the 18th post-operative day.

These two cases were enough to convince those present that Dr. Weiss' theory was indeed a valid one. However, it was recognized that much more must be learned about a technique so different from conventional methods of post-operative amputation management before it could be released generally to the surgical and prosthetic professions.

Accordingly, during the winter and spring of 1964, several amputation centers embarked on a nationwide research program in immediate postsurgical prosthetic fittings. Principal among these centers were the U.C. Biomechanics Laboratory, the Navy Prosthetic Research Laboratory in Oakland, California, The Hospital for Special Surgery in New York City, and the Prosthetics Research Study in Seattle, Washington.

While the other centers undertook this program in addition to their other work, and in most instances without separate funding, the Prosthetics Research Study in Seattle was funded to study this technique by a contract between the Prosthetic and Sensory Aids Service of the Veterans Administration and the Principal Investigator, Ernest M. Burgess, M.D., an outstanding orthopedic surgeon.

The early results using the concept of immediate postsurgical prosthetic fitting were somewhat spotty in all centers. A few of the problems encountered were: pressure necrosis over bony prominences from inadequate casting, delayed wound healing from insufficient controlled pressure to the wound, intermittent edema from distal cast displacement, wound dehiscence due to the cast coming off or too tight a surgical closure, and wounds that would not heal at all due to insufficient blood supply to tissue at the elected level of amputation.



Dr. Marian Weiss of Poland.

The difficulties encountered during the first year of this study seemed in no way related to early ambulation or casting the fresh stump, but rather were thought to be purely technical in nature. The solutions to these problems required the development of considerable technical skill and a professional teamwork approach between the surgeon and prosthetist that did not as yet exist.

It was necessary for each specialist to work closely with, and understand as much as possible, the skills of the other. For example, the surgical fashioning of an amputation stump for the successful fitting of a prosthesis now became mandatory, since the post-operative course was to be one of weightbearing and ambulation with a prosthesis. It was also necessary for the prosthetic application to be such that the wound and remaining extremity would not be damaged or compromised by a continuous rigid dressing and the application of weightbearing forces to diseased or traumatically \* involved tissues. Weightbearing and ambulation must be closely controlled and supervised to avoid trauma. Nurses must be trained to insure that the cast remains in place. The successful rehabilitation of a patient suffering an amputation then required true teamwork, so often spoken of but seldom achieved. The surgeon, prosthetist, physiatrist and/or physical therapist, and nurse, must coordinate their efforts continuously throughout the post-operative period in order to insure the successful completion of the rehabilitation process.

To be sure, the surgeon must be the leader of this team and make the decisions, but he also must recognize and utilize the talents of all other team members, especially the prosthetist.

In the beginning, it was generally assumed that wound drainage was

---

\* Amputation is considered to be trauma.

not necessary if good hemostasis was achieved at the time of wound closure. However, in a few instances, hematomas were developed and the decision was made to drain all wounds to avoid as much as possible this painful complication. Also initially, it was felt that a cast should be applied that represented exactly the contour and fit of a prosthetic socket, providing unrestricted motion of the next proximal joint, i.e., the knee and hip joints. Suspension, or the lack of positive retention of the cast became the big problem. In only a few instances did the cast come completely off, but in a majority of cases, the cast could be displaced enough distally with motion of the next proximal joint to allow the rapid formation of edema.

At this point in the developmental research occurring in this country, it became apparent that a surgical-prosthetic research team should visit Dr. Weiss in Poland to determine exactly the technique he used, and to see his results firsthand. Dr. Burgess, Dr. Robert L. Romano, and the author, all of the Prosthetics Research Study in Seattle, Washington were chosen to make this trip with funds provided by the International Rehabilitation Activities Division of the Vocational Rehabilitation Administration. This agency, as was mentioned previously, had been partially supporting the research of Dr. Weiss for some time with counterpart funds in Poland.

The trip to Poland was made in November of 1964. During the two weeks the U.S. team visited Dr. Weiss, a great deal of information was exchanged and much was learned. For example, Dr. Weiss was able to perform three amputations for our team and demonstrate his then current technique of Immediate Postsurgical Prosthetic Fitting on all three. One above knee, and two below knee patients were amputated with casts and prosthetic extensions applied immediately.

Upon the return of the Prosthetics Research Study team to the United States, both the surgical and prosthetic techniques were refined. Surgery to include tension-myodesis, or muscle to bone fixation, and Penrose drainage extending through and through the wound. The prosthetic technique was refined by immobilization of the next proximal joint for suspension and the addition of a soft compressible material (sterile fluffed gauze or lambs wool) over the end of the stump to produce constant gentle compression of the wound and adjacent soft tissues. In addition, felt pads were designed and included in the cast to provide pressure relief to pressure sensitive areas and to produce controlled pressure over pressure tolerant areas. Also, work progressed on the development of a good prosthetic pylon which would provide features of universal adjustability, light weight, proximal disconnect, and durability.

Thus refined and standardized the evaluation of Immediate Postsurgical Prostheses progressed in an extremely rapid fashion through the years 1965 and 1966.

During the summer of 1966, a preliminary manual titled, "The Management of Lower Extremity Amputees Using Immediate Postsurgical Fitting Techniques," was prepared by the Prosthetics Research Study with the assistance of Mr. A. Bennett Wilson, Jr. The preparation of this manual was requested by the University Council on Prosthetics Education, the members of which were interested in introducing this technique into the Prosthetics Education Programs at UCLA, Northwestern, and NYU. Further, a supplement to the manual describing a new approach to the management of above knee amputations was prepared in December, 1966. Both these publications, originally published in limited supply by the Committee on Prosthetic Research and Development of the National Academy of Sciences, have now been combined into one volume which is available from the Government

Printing Office. Courses on Immediate Posturgical Prostheses are now scheduled for all three universities.

Of course, not all the work done on this technique has been by the Seattle group. In addition to the prosthetic research centers mentioned previously, the Prosthetic Research Center, Prosthetic-Orthotic Department at Duke University Medical Center, the Department of Orthopedic Surgery at the University of Miami, Florida, and many others have contributed much to the growing knowledge in this field. The exchange of information between these centers was made possible by the appointment of an Ad-Hoc Committee on Immediate Postsurgical Prostheses by the Committee on Prosthetic Research and Development of the National Academy of Sciences. The members of this committee were Capt. Frank L. Golbranson, MC, USN, William R. Murray, M.D., and Ernest M. Burgess, M.D. Capt Golbranson served as the chairman of this ad hoc committee.

At this point in time with more than 500 cases having been treated by Immediate Postsurgical Prosthetic Fitting by the research centers mentioned above, the experiences have been such that it is desirable to release the knowledge gained for general application in rehabilitation practices for amputees. The techniques developed through the research program are conservative ones which if followed carefully, should prove successful in almost any setting—small hospital or large medical center. Of course, good clinical judgment still is of paramount importance both surgically and prosthetically. However, with the surgeon, prosthetist, physiatrist, physical therapist, etc., all working together as a team for the benefit of the patient, some spectacular results can be obtained.

As we look into the future, there is, of course, much still to be done. Improvements in surgery—level selection in vascular cases, improved tension myodesis, implants, etc., and in prosthetics—direct socket forming with plastics on stumps, improved permanent pylon designs, externally powered lower extremity prostheses, etc., are sure to come. The progress made over the past three years in the investigation of Immediate Postsurgical Prostheses has opened wide the doors for future improvement in the rehabilitation of amputees. We all look forward eagerly into the ever changing future and the continuing march toward the elimination of physical disability.

