A Clinical Appraisal of the Plastic Total Contact Above Knee Prosthesis

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Evaluation of fifty-one unselected above knee amputees for whom this prosthesis has been prescribed reveals satisfactory results. A brief description is given of a fitting technique and the reaction of the stump to total contact. The advantages of this socket over other above knee sockets are apparent from its beneficial effects on several stump disorders.

About ten years ago we began supporting the soft tissue of a stump with an improvised total contact socket which would furnish partial end bearing in above- and below-knee prostheses. Pads of felt, leather, rubber and plastic foam were inserted into the ends of the sockets to provide comfortable support. In 1958, the University of California in Berkeley published the first of a series of reports that have led to vast improvements in the fabrication, fitting and alignment of the patellar-tendon-bearing total-contact prosthesis. Our early clinical experiences with this prosthesis have been reported elsewhere.[1]

The plastic total-contact above-knee prosthesis fabricated by the University of Michigan Prosthetic Shop is similar to the prostheses described by the University of California research laboratory in Berkeley and by the Veteran's Administration Prosthetic Center in New York City.[2] A quadrilateral wooden proximal socket is designed from conventional stump measurements. This socket is about four inches long and is fitted in an adjustable casting stand (Figure 1). To insure initial flexion and adduction of the socket, the distal portion of the stump protruding from the wooden socket is wrapped with plaster in the ischial weight-bearing position (Figure 2). A plastic socket is subsequently fabricated from the wooden pattern and plaster cast (Figure 3). This technique is preferred to other casting methods: it provides total contact, optimal alignment and partial ischial weight bearing. The discrepancy in the dimensions of the socket gradually changes from values of minus 1/4 to 1¼ inches at the level of the ischial tuberosity, to plus ¼ to ½ inch at the end of a mid-thigh stump. Several methods of estimating end bearing have been tried. Practical clinical methods include placing a piece of clay or bouncing putty, comparable in size to a small pea, in the bottom of the socket. It will be flattened with end bearing. Or the examiner's small finger is inserted through the valve opening in the non-weight bearing position to gauge the pressure exerted between the stump and the socket when the amputee has put his weight on the prosthesis.

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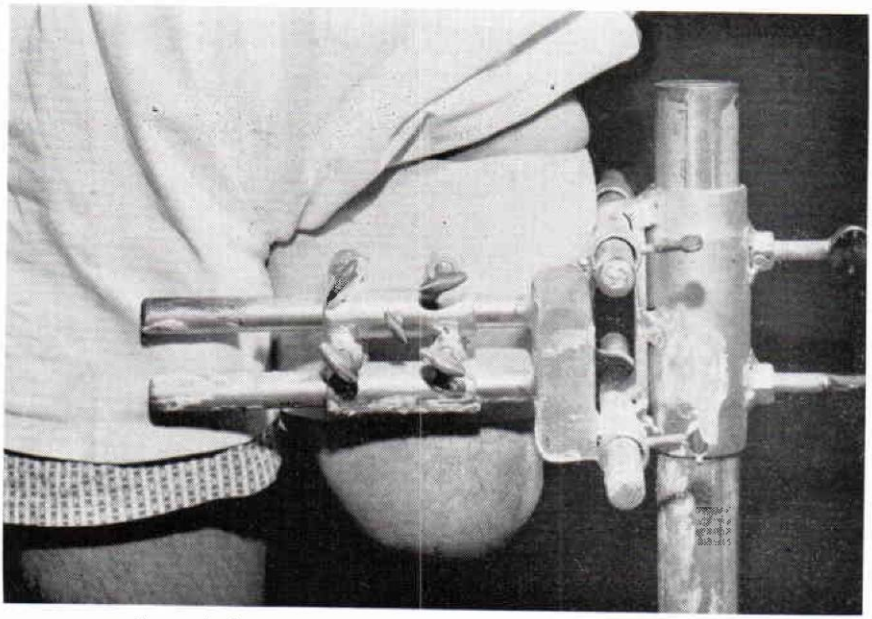


Figure 1. Proximal socket fitted in an adjustable casting stand.

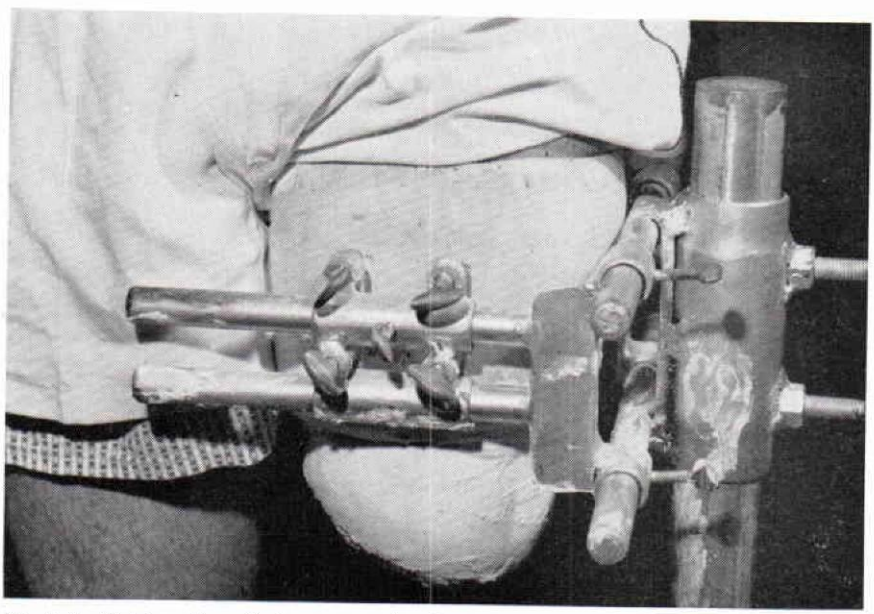


Figure 2. Distal portion of stump protruding from proximal socket wrapped with plaster in the ischial weight bearing position.

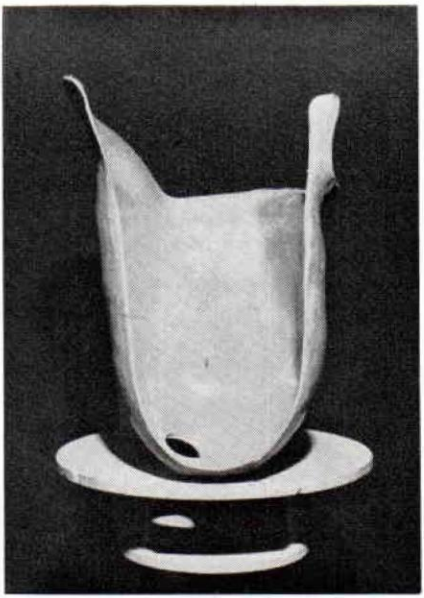


Figure 3. Unfinished plastic socket—split to demonstrate inner wall.

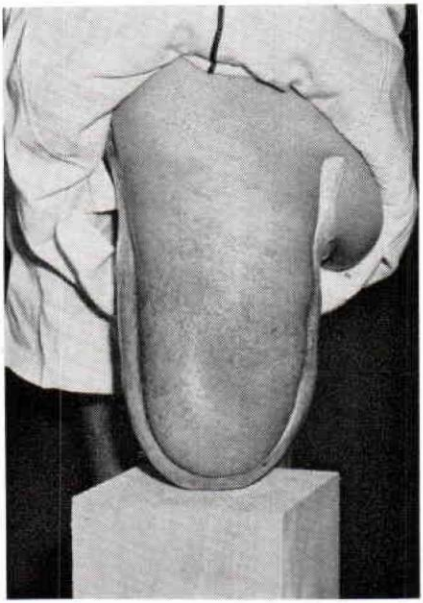


Figure 4. Socket is split to demonstrate relationship of total-contact socket and stump.

Since November 1960, the total-contact socket has been prescribed for 51 unselected above-knee amputees. Periodic evaluations have been made of all patients for at least three months following each fitting. Only one patient rejected the socket. He was accustomed to obsolete methods of fitting and suspension and, despite a tender bony stump, preferred a plug fitting socket. Those who had previously worn open end sockets preferred the total-contact socket; they had better control of the prosthesis and were more comfortable.

The committee on Prosthetic Research and Development of the National Academy of Sciences has reported that counter pressure on the end of a stump will promote circulation and lessen edema.[3] This clinical study supports their report. The total-contact socket is impressively effective in lessening chronic stump edema. It has also lessened fibroelastic diathesis, varicosities of the stump, and irritation about the ischial tuberosity.

The discrepancy between dimensions of socket and stump appear to be less critical if soft tissue is supported at the lower half of the stump. With such support, the tissue is displaced towards the upper half. Fewer adjustments are required to prevent the ischial tuberosity from slipping anteriorly over the brim of the ischial seat. The plastic total-contact socket seldom develops cracks, and the valve seal is easier to maintain than it is in wooden sockets. It would appear that spurs at the end of the femur do not occur more frequently in partial end bearing than in open-end sockets. A patient with a normal stump is seldom aware of end bearing, and the person with a moderately tender stump readily adapts to this socket. A tapered stump frequently takes on a more cylindrical shape after using the socket for a few months, and a bony stump may develop small asymptomatic bursae in response to partial end bearing. Nerve pressure syndromes of phantom sensation and phantom pain are less frequent, because pressures

are more widely distributed than they are in open end sockets.

The additional step needed to fabricate the plastic total-contact above-knee prosthesis is justified by the numerous advantages over other above knee sockets.

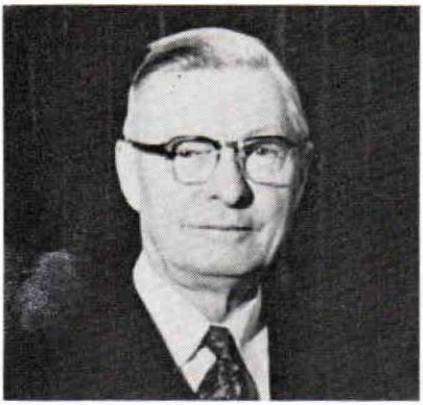
REFERENCES

1. Wolcott, L. W. and Koepke, G. H.: Arch. Phys. Med. and Rehab. Vol. 43: Sept. 1962.
2. Report: Jan., Feb., Mar., 1960. Biochemics Lab. Univ. Calif.—Berkeley, April 8, 1960. p. 2, 3, 4.
3. Annual Report of Activities of the Committee on Prosthetics Research and Development, National Academy of Sciences, July '61 to June '62.

In Memoriam

Frank Oliver Peterson

Frank Oliver Peterson, member of AOPA from Los Angeles, died suddenly September 28th at Los Angeles at the age of 81.



Mr. Peterson and his wife, Mrs. Ethel E. Peterson, had long been active in the affairs of the Association, dating back to their earlier connection with the Rowley Company. Mr. Peterson was a former Treasurer of the Association. Since his retirement to live in Los Angeles he had also served as the Treasurer of the Society of Orthotists and Prosthetists, and took an active interest in the affairs of Region IX of AOPA. Mrs. Peterson is well known for her many years as editor of the ALMA *Almanac*, published in the early 1940's.

MRS. RUTH BEITMAN

The *Journal* has learned with deep regret of the death in October of Mrs. Ruth Beitman, of Newark, New Jersey. Sincere sympathy is extended to her husband, Arthur A. Beitman, and to members of the family.

FREDERICK E. VULTEE, M.D.

Dr Frederick E. Vultee, Chairman, Dept. of Physical Medicine and Rehabilitation, Medical College of Virginia, Richmond, died suddenly after a heart attack on December 4, 1962.

His contribution to the prosthetic and orthotic field was an outstanding one, and his death is a severe loss to the profession and to his many friends.

A Memorial, by Dr. J. Warren Perry, OVR, will appear in the March 1963 *Journal*.