

Final Report:

The Above Knee Study Committee

University Council on Orthotic and Prosthetic Education

INTRODUCTION

The first report of the Above Knee Study Committee was published in the June, 1962 *Orthopedic and Prosthetic Appliance Journal*, pp. 157-159. It will be recalled that the Study Committee was appointed by the University Council on Orthotic and Prosthetic Education (UCOPE) because of the recognition of a need for closer cooperation and coordination between the three University Teaching Centers which make up the Prosthetic and Orthotic Education Program in the United States. The mission assigned to the Committee was to analyze and compare the principles and techniques taught at each university with regard to wood socket above-knee prosthetics so that differences could be isolated, discussed, and if possible reconciled.

In carrying out this assigned responsibility, the Committee has met three times. The first meeting was held in Los Angeles in February, 1962, and the second and third meetings took place at New York University in July and September of 1962. These meetings, each of which occupied several long working days, resulted in a final report which we believe will be of interest to every prosthetist engaged in the fitting of above-knee amputees.

SOCKET PLANNING

It will be recalled from the earlier report that there are two different methods currently being taught for preparing a socket pattern at ischial level. These can be called the "pattern modification" method which is used at New York University and the "pattern construction" method which is used at Northwestern University and at the University of California at Los Angeles. Many hours of discussion and practical work with both methods led to the findings that:

1. *The M-L Dimension*

a. *Difference.*—Patterns made according to the instructions of the "pattern construction" procedure tend to be wider in the M-L dimension than patterns for the same amputee made in accordance with "pattern modification" procedures.

b. *Reconciliation.*—The Committee agreed that the "pattern construction" procedures would be altered so as to produce a pattern 3/16" smaller from medial to lateral sides.

2. *The Rectus Femoris Channel*

a. *Difference.*—The constructed patterns tend to have a shallower rectus femoris channel than the modified patterns.

b. *Reconciliation.*—Once again, agreement was reached that the construction procedure would be altered so as to deepen the rectus femoris channel by 1/8" increments.

3. *Posterior Wall Angulation*

a. *Difference*.—Depending on stump musculature, the constructed patterns have an angle between the medial and posterior walls that varies from 6 to 10 degrees. In contrast, the modified patterns used by NYU have maintained a constant angle of 7 degrees.

b. *Reconciliation*.—A partial agreement was reached on this point with the understanding that the NYU faculty does not consider this angle as unchangeable. If needed for a particular patient, pattern modification procedures now permit changing this angle for the purpose of obtaining proper pattern perimeter.

Given the above agreements, patterns for the same amputee made at any of the three Universities will be considerably more similar than they would have been a year or two ago. It should be pointed out, however, that none of the Universities are willing to discard the approach to pattern making currently being taught. NYU plans to continue arriving at the final pattern with a pattern modification approach and NU and UCLA will continue to teach a pattern construction approach.

SOCKET LAYOUT

1. *Adduction and Flexion Angles*

a. *Difference*.—For some years, NU and UCLA have laid out on the socket block the adduction and flexion angles derived from measurements on the amputee. In contrast, NYU has not been preparing the socket block to reflect these angular measurements because of the feeling that these angles could be determined only with the amputee walking on the socket and an adjustable leg.

b. *Reconciliation*.—The Committee learned during the discussion of this point that for the past year NYU has been measuring adduction and flexion of the amputee's stump and preparing the socket block in accord with the measured angles. Consequently, at the present time there is no difference with regard to this procedure.

2. *Lateral Wall Undercut*

a. *Difference*.—To provide an undercut on the lateral wall above ischial seat level, the proximal pattern is moved medially on the socket block approximately $\frac{1}{2}$ " by NYU, $\frac{3}{8}$ " by NU and $\frac{1}{4}$ " by UCLA. As a result the NYU sockets display the largest undercut and the UCLA sockets display the least amount of undercut.

b. *Reconciliation*.—Agreement on this point was achieved by an understanding that all schools will teach a standard $\frac{3}{8}$ " for pattern displacement. It is recognized by the Committee that this standard amount may have to be varied for a particular patient but it is felt that a $\frac{3}{8}$ " medial displacement of the pattern will provide the proper amount of undercut for most patients.

3. *The Distal Pattern*

a. *Difference*.—For the planning of the distal pattern, NU uses a perimeter that is 1" less than the most distal stump measurement, NYU uses 2" less than the most distal stump measurement and UCLA uses the tension value plus $\frac{1}{16}$ " at the most distal measured level. This distal pattern is used in the socket block by NU and UCLA at the level of the most distal stump measurement, whereas NYU uses this pattern 2" below the end of the stump on the bottom of the socket block.

b. *Reconciliation.*—While instructions for planning and locating the distal pattern obviously vary at each of the three Centers, it is important to point out that all three methods are designed to produce the same desired result, that is, a distal socket circumference in accord with the tension analysis chart. The Committee feels that any procedure in planning and locating the distal pattern is acceptable as long as it achieves this result.

INITIAL SHAPING

In discussing the general approach to initial shaping as taught at the three University Centers, it was found that though there are some deviations in technique, the goal of the shaping procedure is the same at each University, that is, to produce a socket with appropriate contours and with measurements in accord with the tension analysis chart. The differences are considered simply individual preferences in going about the shaping process. For purposes of this report, therefore, the Committee wishes to describe two general approaches to initial shaping rather than listing differences and reconciliations.

The approach to initial shaping at NU and UCLA is to work on one socket wall at a time. The lateral, posterior, anterior, and medial walls are successively shaped. Throughout the shaping process great emphasis is placed on continual use of "devil level" goniometers to insure the maintenance of planned flexion and adduction angles in the posterior and lateral walls.

The approach at NYU is to first open the socket generally and then concentrate on each wall successively in the same order as mentioned above. There is less rigid insistence on the maintenance of flexion and adduction angles since it is assumed that these measurements, while useful, are only approximations and that final determination can be made only when the socket is worn by the amputee. NYU does, however, place both the distal pattern and the ischial level pattern at the same distance from the exterior surface of the lateral wall. Since as mentioned earlier the socket block incorporates the planned adduction angle, connecting the two patterns tends to maintain the adduction angle and produces a medial wall that is not vertical.

While the general approaches to initial shaping are quite similar, the Committee did isolate two specific differences which should be mentioned:

1. *Shelves or Shoulders in the Distal Socket*

a. *Difference.*—Placement of the distal pattern at the level of the most distal stump measurement enables NU and UCLA to have wood shelves curving in under the end of the stump. The socket thus maintains contact with distal stump tissues as completely as possible without being a total-contact closed end socket. In the case of NYU, placement of the distal pattern 2" below the end of the stump means that the socket does not have shelves or shoulders curving in under the end of the stump.

b. *Reconciliation.*—No attempt was made to reconcile this difference since the Committee feels that current work with wood and plastic total-contact sockets will in all likelihood make the difference insignificant.

2. *Posterior Wall Contour*

a. *Difference.*—Underneath the ischial seat, the posterior walls of NYU sockets are usually contoured with a moderate radius both proximal-distal and medial-lateral. In other words, there is a shallow concavity in two planes.

In contrast to this, the posterior walls of NU and UCLA sockets tend to be flat in both planes.

b. *Reconciliation.*—In discussing this difference, it was found that UCLA feels strongly about maintaining the flatness of the posterior wall. NU feels less strongly about this and does, at times, permit a slight concavity on the medial side of the posterior wall. NYU feels strongly that contouring in this area is important for comfort and retention of the socket. The Committee felt that the middle position of NU offered a reasonable compromise. It was agreed, therefore, that if a concavity is needed to insure a comfortable fit for a particular patient, instruction at each University would permit this socket modification. The amount of emphasis placed on this point at each school is, of course, left to the judgment of the respective prosthetist faculties.

In concluding their report, the Committee wishes to state its feeling that:

a. There is, at this moment, considerably less divergence in teaching at the three University Centers than there has been for the past several years. There has been, over the years, a natural evolution in the theory and methods presented at each of the Universities. This evolution has tended to proceed along the same lines so that the current differences are primarily in the area of "how to do it" details rather than in basic principles. In fact, in the Committee's opinion the similarities are much more striking than the differences.

b. The Committee would welcome correspondence from readers of this report regarding any of the differences and reconciliations discussed, or regarding other differences which may have been overlooked. Such correspondence may be addressed to Norman Berger, 342 E. 26th Street, New York 10, N. Y.

c. The three meetings of the Committee have been of significant help in producing increased understanding of the teachings at each Center, and in providing an opportunity for cooperation and exchange of ideas among the prosthetist faculties.

d. It is the Committee's recommendation that all areas of instruction and problems be given the same continuing productive treatment as has the A/K situation. With this report, the Committee feels that it has discharged the responsibility assigned to it by UCOPE.

Submitted by:

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