Aids Service, Veterans Administration, 252 Seventh Avenue, New York, New York 10001.

Lewis, E.A. and Bernstock, W.M., "Clinical Application Study of the Henschke-Mauch Model A Swing and Stance Control System." *Bulletin of Prosthetics Research* Fall, 1968.

Mauch, H.A., "Stance Control for Above-Knee Artificial Legs—Design Considerations in the S-N-S Knee." *Bulletin of Prosthetics Research,* Fall 1968.

Knee Prostheses, Mauch Laboratories, Inc., 3035 Dryden Road, Dayton, Ohio 45439, January 1974.

Murphy, E.F., "The Swing Phase of Walking with Above-Knee Prosthesis." *Bulletin of Prosthetics Research,* Spring 1964.

Staros, A. and Murphy, E.F., "Properties of Fluid Flow Applied to Above-Knee Prostheses." *Bulletin of Prosthetics Research,* Spring 1964.

# Hydraulic/Pneumatic Knee Control Units A Prosthetist's Point of View

## Charles H. Pritham, CPO*

As Mr. Wilson has demonstrated, the use of hydraulic and pneumatic control units had its genesis in the post World War II R & D effort. The objective, of course, was to fit the returning veteran AK amputee with the best prosthesis technology could provide. Such amputees were young and physically fit, prime candidates to benefit from the advantages of advanced control units. The prime advantage, usually cited, is cadence responsiveness. As the patient walks at different rates, the control unit automatically adjusts to control heelrise and terminal swing impact. Constant friction knees can not duplicate this feature. All hydraulic and pneumatic units provide this feature and one, the Mauch S-N-S, provides stance phase control as well. This means that the unit provides enhanced knee stability in the early portion of stance phase to increase the patient's safety.

In this mode, the S-N-S unit can be said to function in a fashion analogous to that of a conventional safety knee. In another mode, the function of the S-N-S can be likened to that of a simple manually locking knee. Two other knee control units, variants of Kingsley's Hydranumatic and USMC's Dynaflex, function in a similar fashion.

The Hydracadence, in addition to swing phase control, also provides heel height adjustability and toe pick-up. Otto Bock has recently introduced a modular knee that includes a hydraulic swing phase control.

As can be seen then, these are just a few of the variations available to the prosthetist and his patient. The principle advantages claimed for such control units are enhanced cosmesis and performance, and lower energy expenditure. Against these advantages the disadvantages must be weighed. Bulk, size, and weight of some of the units preclude their use by many patients. The considerable expense of most, if not all, hydraulic and pneumatic control units rules out others. Moreover, the control units have shown to be unreliable. Some patients derive satisfactory service from their units while other patients using the same brand unit are constantly having them replaced and repaired. As most of the units need to be factory serviced, the delay and expense of maintaining a unit under such circumstances can engender considerable frustration.

Given these circumstances, the pool of available amputees for whom such advanced control units are suitable is a small proportion of the total AK population, and most closely resembles the patients for whom they were originally developed: young traumatic males; i.e. veterans. It must be borne in mind that this pool today represents a less important proportion of the amputee population than it did some 25 years ago. Statistics demonstrate that the majority of civilian amputees in the Western World are geriatrics who lose a leg due to arteriosclerosis and are as often as not female. Indeed, the very amputees who were originally provided hydraulic units by the VA are not getting any younger. The day will come for each of them when they, and the clinic teams who attempt to address their needs, must make a reappraisal of their prescription. So, the use of hydraulic/pneumatic control units for a considerable portion of the amputee population can be ruled out. Not only that, but it is possible to be very skeptical in considering the suitability of such units for patients for whom it is theoretically ideally suited.

Young, active traumatic amputees are probably, children aside, the hardest on their prostheses. Given the expense of purchasing and maintaining such a unit, does it make sense to fit an amputee with one if he is going to have more than average maintenance problems? Can he afford the time lost from work, interruptions in his daily life, and expense of repairs? Given the disproportionately rising cost of health care today, can society? Gait studies demonstrate that AK amputees walk slower than normal subjects and BK amputees because of increased energy expenditure. If this is so, is the prime advantage cited for hydraulic/pneumatic units, cadence response, relevant and worth the additional expense and problems? In another vein, given the aging nature of the population should further effort and money be devoted to developing newer and more sophisticated knee control units?

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In any event, it can be said that a prosthetist in attempting to formulate a solution to his patient's problems is confronted with a number of questions and a wide variety of devices all intended to perform the same function. It is also true that the prosthetist has little more than personal experience, hearsay, and the competing claims of the manufacturers to aid him in making his decision. The natural tendency on the prosthetist's part is to provide his patient with the most sophisticated unit possible, for all of us gain considerable satisfaction from doing so and from working with such units. The patient also wants the best prosthesis possible. The fact remains, however, that such tendencies must be resisted and both prosthetist and patient must make a realistic appraisal of the situation and logically weigh the pros and cons.

# *Questionnaire*

*The* Clinical Prosthetics and Orthotics—C.P.O. *editorial board believes that two-way communication will aid the growth of the profession. The Academy provides a forum, within this publication, through which practitioners can let their voices be heard on significant issues. Please take the time to complete the questionnaire on professionalism and return to: Charles H. Pritham, CPO, Editor,* Clinical Prosthetics and Orthotics, *c/o Durr-Fillauer Medical, Inc., Orthopedic Division, 2710 Amnicola Highway, Chattanooga, TN 37406.*

1. For what percentage of your AK amputees would you consider hydraulic/pneumatic control units relevant?
   0–20% _____ 60–80% _____
   20–40% _____ 80–100% _____
   40–60% _____

2. Of those for whom you consider such units suitable, what percentage are using them?
   0–20% _____ 60– 80% _____
   20–40% _____ 80–100% _____
   40–60% _____

3. Are you and your patients satisfied with the units?
   Yes _____ No _____

4. Do you think further R & D is justified and necessary?
   Yes _____ No _____

5. Name the hydraulic/pneumatic control unit most frequently used in your practice.
   _____

6. Additional comments:
   _____
   _____
   _____
   _____
   _____

# *Results from the Questionnaire on Cervical Orthoses*

There were 13 respondents who answered as follows:

1. Do you feel there exists a need for further research in cervical orthotics?
   Yes—12 No—1

2. Do you feel such research would affect your practice?
   Yes—9 No—4

3. Do you feel there exists a need for a non-invasive halo?
   Yes—9 No—2 Question—2

4. Do you as an orthotist currently participate in the application of Halo-Vests?
   Yes—5 No—7
   One respondent, a physician, indicated the question was not applicable. This same individual indicated that the cervical orthosis he used most frequently was a Halo, followed by the S.O.M.I. and Philadelphia Collar, in that order.

5. List, in order of frequency, the three most commonly used cervical orthoses in your practice.

| Orthosis | Total no. of times mentioned | Frequency Listed 1st | Listed 2nd | Listed 3rd |
|---|---|---|---|---|
| 1. Philadelphia Collar | 10 | 3 | 5 | 2 |
| 2. S.O.M.I. | 10 | 3 | 4 | 3 |
| 3. Soft Collar | 6 | 3 | 1 | 2 |
| 4. Halo | 5 | 2 | 0 | 3 |
| 5. Four-Poster | 3 | 1 | 1 | 1 |
| 6. Plastic Cervical Orthosis | 2 | 0 | 1 | 1 |
| 7. Thomas Orthosis | 1 | 0 | 1 | 0 |
| 8. Dennison Two-Poster | 1 | 0 | 0 | 1 |
| 9. Modified Florida Orthosis | 1 | 1 | 0 | 0 |

As always with so small a sample, it is impossible to draw any meaningful conclusions. The answers to questions one through four pretty well speak for themselves;