The Plastic Syme Prosthesis in Canada

C S. BOCCIUS[1]

Opinion concerning the long-term efficacy of a Syme amputation stump is by no means unanimous. The obvious advantages of a stump that will tolerate full end-bearing and that may, if necessary, be walked upon without a prosthesis are considered by English surgeons to be offset by the likelihood of early breakdown of the stump and the later necessity for reamputation at a higher level. But the experience and consequent feeling in England is not shared by surgeons connected with Canada's Department of Veterans Affairs. The simple reason is that excellent and enduring results have been obtained in a goodly number of Syme amputations observed in Canada during and since World War I.

Were these results influenced by superior prostheses or better prosthetic management on the part of DVA? It would be nice to be able to answer in the affirmative, but it is more likely that these Canadian stumps endured in spite of prostheses none too adequate, for the techniques and designs adopted by DVA's Prosthetic Services have differed little from those used elsewhere. The experience of DVA surgeons (page 44) reveals that, in performing the amputation, they adhered as closely as possible to the account of the surgical procedure originally published by James Syme in 1843, while surgeons in other parts have modified Syme's technique with the object of producing stumps easier to fit with a more sightly prosthesis. There seems to be little doubt but that the superior results obtained in Canada have been due chiefly to adherence to classical procedure. But since it is known that in his accounts of his work Syme himself was seldom if ever meticulous as to detail, some credit is owing particularly to Dr. Gordon M. Dale, the man largely responsible for DVA policy in the matter, for having" accurately interpreted and perhaps incidentally improved upon Syme's intentions. Possibly the term "Canadian Syme" should apply as much to DVA's surgical procedure as to its new prosthesis for the resulting stump.

[1] Manager, Prosthetic Services, Department of Veterans Affairs, Toronto, Ontario, Canada.

DEVELOPMENT OF THE CANADIAN-TYPE SYME PROSTHESIS

Syme stumps created by classical procedure are longer and more bulbous than are those obtained through modified techniques. In the corresponding prosthesis, therefore, the size of the opening needed for entry of the stump and the limited amount of space available for inclusion of an ankle joint and foot together require strong construction, and the result is often ugly. Despite these difficulties, DVA prosthetists managed to construct and fit Syme prostheses that were as good as, if not better than, those to be found elsewhere, although it must be admitted that the devices were often very heavy and in some cases not particularly durable. During the period 1926-1950, a few all-metal Syme prostheses were tried in Canada. The first ones, made from aluminum alloy, were exceptionally light, but few of them withstood the rigorous usage of Canadian amputees. An improved design, made from Monel metal and therefore as heavy as, if not heavier than, the standard type, proved exceptionally durable, but its construction was so difficult and time-consuming that it could not be adopted for general use. Of a few fitted to those who too frequently broke standard prostheses, however, some lasted through 15 to 20 years of continuous service, so that it became obvious that it must be possible in some way to produce a stronger, lighter, and neater appliance.

In 1944 a program of research toward the improvement of prostheses generally was undertaken by the National Research Council of

Table 1

EXPERIENCE WITH THE CANADIAN-TYPE SYME PROSTHESIS

Plastic Syme Prostheses Made Since 1954	Prosthetic Centre of Origin												
	To.	Lo.	Mo.	Ot.	St.	Hx.	Wi.	Re.	Ca.	Ed.	Va.	VaS.	Totals
Cases attempted	122	10	7	—	9	—	6	4	3	4	8	3	176
Cases satisfactory	113	10	7	—	9	—	4	4	3	4	4	3	161
Bilateral Syme included	5	—	—	—	—	—	1	—	—	—	—	—	6
Duplicate provided	16	1	4	—	—	—	1	1	3	3	—	—	29
Appliance satisfactory	134	11	11	—	9	—	6	5	6	7	4	3	196
Fitted but not accepted	3	—	—	—	—	—	2	—	—	—	3	—	8
End-bearing not tolerated	6	—	—	—	—	—	—	—	—	—	1	—	7
Replaced owing to poor fit	5	—	—	—	—	—	—	—	—	1	—	—	6
Replaced owing to breakage	3	1	—	—	1	—	—	1	1	1	—	1	9
All appliances made	151	12	11	—	10	—	8	6	7	9	8	4	226

$$\frac{\text{Cases satisfactory}}{\text{Cases attempted}} = \frac{161}{176} = 91.5\%$$

$$\frac{\text{Satisfactory prostheses}}{\text{All prostheses made}} = \frac{196}{226} = 86.7\%$$

Canada (Ottawa) at the request of its Committee for Medical Research. Col. R. I. Harris, then Medical Advisor to the Canadian Armed Forces and orthopedic consultant to DVA, and Major C. A. Bell, then Director of Prosthetic Services, were chiefly responsible for initiating this activity and for providing the necessary impetus as well as the required liaison between the Council and Prosthetic Services. Although between the years 1948 and 1952 there was a pause and a transfer of activities to a new Prosthetic Centre at Sunnybrook Hospital, Toronto, one of the direct results of the investigation was the development of the appliance that has now come to be known as the " Canadian-Type Syme Prosthesis," or more simply in Canada as the "Plastic Syme.'[7] It was May 1954 before development had progressed to the stage where it was felt the device had sufficient merit to warrant its adoption throughout Prosthetic Services. DVA centres outside of Toronto were at the time unfamiliar with plastic techni-

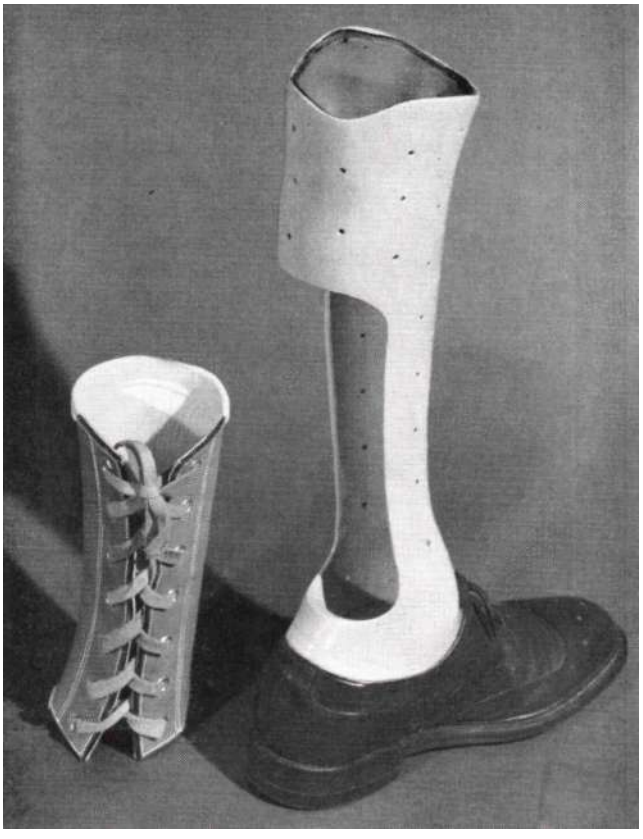

Fig. 1. Plastic Syme prosthesis with tibial bearing.

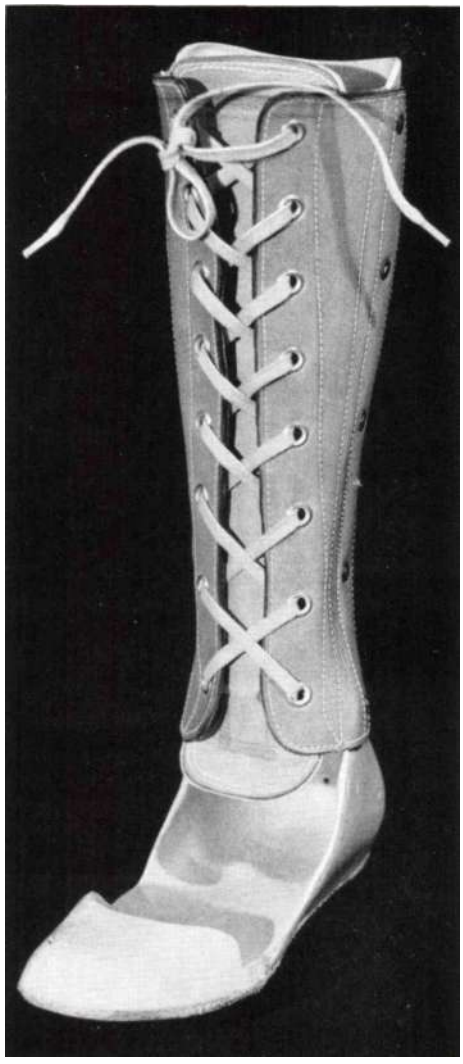

Fig. 2. Adaptation of the plastic Syme prosthesis for use with the Chopart stump.

ques, and it was therefore necessary to bring fitters to Toronto from all parts of the Dominion for training.[2]

CLINICAL RESULTS

Since that time, plastic Syme prostheses have been made throughout Canada for 176 cases, and of these one hundred and sixty-one (91.5%) are fitted satisfactorily (Table 1). Five of the remaining 15 complained that they did not like the SACH foot, and three found the plastic socket too cold in winter. In the remaining seven cases, which include one bilateral for whom the stumps are troublesome after 23 years of service and six primary cases whose stumps would not tolerate end-bearing and were therefore referred for further surgical attention, fitting was not brought to a satisfactory conclusion. Of the 161 satisfactory cases, six are bilaterals requiring two prostheses each, and 29 are individuals who, since they reside at considerable distances from fitting centres, were supplied with duplicate prostheses. In all, then, 196 satisfactory prostheses are in use by the 161 cases. Besides the 15 cases not satisfactorily equipped, six required a second prosthesis because the first was not properly fitted, and nine required replacements owing to structural failures that occurred in early models. Thus, for 176 cases, 226 appliances were constructed, and 196 of them are in satisfactory service. In this light, it may be said that the useful product was 86.7 percent of the total input.

SPECIAL ADAPTATIONS

Stumps which do not tolerate full end-bearing are referred routinely for re-examination by the surgeons, but occasionally no indication for further surgery is revealed or else surgery is contraindicated by physical condition. In such cases, an attempt is made to substitute tibial-bearing for end-bearing by fitting the upper part of the socket in the same manner as for a below-knee stump. Additional care is taken to size and modify the top of the cast before making the socket over it. Instead of being split medially and laterally as usual, the top of the socket is left whole, but the back is cut away just high enough to produce an aperture through which the stump can be squeezed and just low enough to allow its re-entry at the bottom (Fig. 1). A soft leather gaiter, slightly shorter than the cutout, is then wrapped completely around and laced in front. Although at first a snug fit must be achieved at the top in order to remove weight from the stump end to whatever extent is necessary, after the appliance has been used for a few weeks most of the weight is commonly taken on the end and tolerated without complaint. In only comparatively few cases is it necessary to maintain the snug fit at the top permanently.

[2] Which is to say that production outside of Toronto was not at the time in the hands of experts.

Although Figure 2 illustrates an appliance for Chopart's amputation and therefore does not properly belong here, it shows an interesting extension of the technique used in construction of the plastic Syme prosthesis. The partial-foot amputee for whom this particular device was made could not be fitted comfortably with a conventional Chopart appliance because the inferior and anterior aspects of his stump at the site of amputation were unduly sensitive to pressure. The open-front socket of the Syme adaptation consists at the back of a rigid structural member continuing around the heel into a sturdy sole plate, which in turn extends past the stump, across the metatarsal heads, to the usual line of the toe joints, where a flexible toe piece is attached. Between toe piece and stump is left enough space so that the former, when dorsiflexed, does not impinge on the anterior aspect of the stump. Upward pressure across the metatarsal line during walking tends to force the socket away from the calf, but since the socket is secured firmly to the shank it does not move and therefore does not allow the sole plate to press upward against the inferior aspect at the stump. In the taking of the cast for such an appliance, the foot stump should be set in sufficient plantar flexion to accommodate the heel of the shoe.

CONCLUSION

The figures given in Table 1 are the result of slightly over four years of routine use of the plastic Syme prosthesis. In Canada, once an appliance is in routine use no clinical procedure is followed, and it is then impossible to give a detailed account of each fitting. But because of the degree of similarity that exists among all Syme stumps no particular object would be served by doing so. A Syme stump that will not tolerate full end-bearing is considered subnormal and is treated according to the system already outlined. Additional measures, such as the provision of side joints and ischial-bearing corset may be taken to avoid further surgery, but when they prove to be necessary the case is considered a failure as a Syme. While the plastic Syme prosthesis offers adaptability to all fitting requirements, its chief advantages lie in its improved appearance with reduced weight, its improved durability by virtue of a stronger structure, its freedom from mechanical components subject to malfunction, and its reduced cost owing to simplicity in manufacture.