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# Casting the through-knee stump

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**Abstract**

The general characteristics of the through-knee stump are outlined and the casting technique is described in detail.

## Introduction

The most important and difficult procedures in prosthetic fabrication are associated with the design and fitting of the socket, which constitutes the critical interface between the amputee's stump and the prosthesis.

Regardless of type, the socket must transmit, in a comfortable manner, the static as well as dynamic body weight to the remaining part of the prosthesis, and it must be shaped to provide stabilization of the stump within the socket so as to enable the amputee to transfer his own movements into functional prosthetic movements. If the socket fails to fulfil these requirements, not even the most sophisticated knee mechanism and prosthetic foot will function properly.

The most important steps in the manufacturing of the socket are the procedures of taking the negative cast and the consequent modification of the positive cast.

## Through-knee stump characteristics

When the through-knee (TK) amputation has been performed correctly and no post-operative complications have occurred, the stump presents the following characteristics:

1) It is end-bearing, i.e. the body-weight can be transferred to the prosthesis through the distal part of the stump.
2) The long stump provides effective medio-lateral stability with a minimum of pressure.
3) The stump musculature has a good functional status.
4) The distal part of the stump is normally bulbous; this shape provides an excellent means of suspension of the prosthesis.
5) Proprioception is good.

With reference to the above mentioned characteristics, the aim of the casting is to produce a negative cast where the distal part is identical in shape to that of the stump, in order to ensure a comfortable transfer of body weight as well as providing adequate suspension of the socket to the stump.

Furthermore, biomechanical analysis indicates that, immediately after heel-contact, the stump is forced backwards in order to maintain knee stability. This action continues through the mid-stance phase of the walking cycle.

Biomechanical analysis also indicates that the stump is forced laterally during mid-stance, when the opposite leg is in the swing-phase.

Distal-lateral and distal-posterior pressure against the stump just proximal to the femoral condyles must be provided for during the casting procedure, otherwise problems as a result of pressure on the distal-lateral-posterior area of the femoral condyle will result during the stance-phase, as a consequence of the stump action.

## Casting procedure

The casting procedure described assumes that the amputee is able to stand in an upright position when casting is performed.

Before casting, circumferential measurements of the stump—beginning 5 cm (2 in) proximal to the distal surface and continuing proximally with

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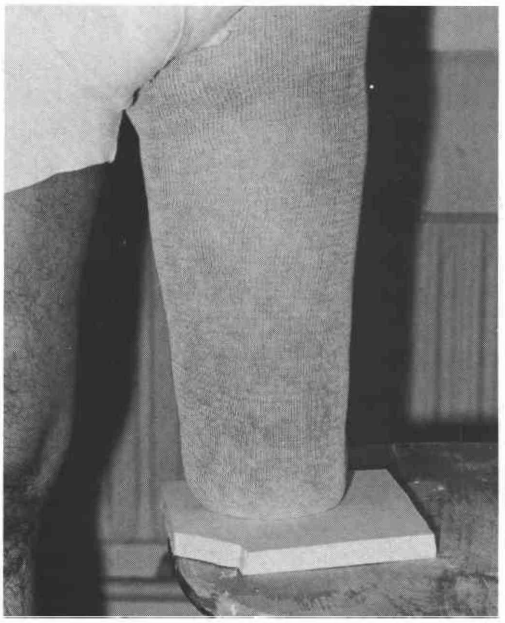

Fig. 1. The stump, which is supporting about half the body weight, is placed on the adjustable platform.

5 cm intervals to a level approximately 5 cm below the ischial tuberosity—are recorded. These measurements may serve as a guide during the cast modification procedure.

A wet cast sock is applied to the stump and suspended over the shoulder. Have the amputee support approximately half the body weight through the end of the stump, which is placed on an adjustable platform covered with a 2·5 cm (1 in) thick Plastazote (Fig. 1) Adjust the height of the platform until the pelvis is horizontal.

Fig. 2. Following the plaster wrap, pressure is applied on the lateral and posterior aspects of the stump just proximal to the femoral condyles.

Remove the stump from the platform and wrap plaster bandage around the stump, beginning distally and extending proximally to a level approximately 2–3 cm (1 in) below the ischial tuberosity.

Have the amputee resume the position with the stump supported on the Plastazote. Be sure the stump is in normal position with respect to abduction, adduction and flexion-extension.

Apply pressure on the lateral and on the posterior side just proximal to the femoral condyles (Fig. 2).

Before the cast has set, shape the posterior proximal part to be flat (Fig. 3, top), and mould the area corresponding to the Scarpa's triangle (Fig. 3, bottom).

Use of the Plastazote provides exact contours of the distal part of the femoral condyles in the negative cast and secures proper distribution of pressures during weight-bearing.

The flat posterior surface provides sitting comfort, and the moulding of the area corresponding to Scarpa's triangle allows proper

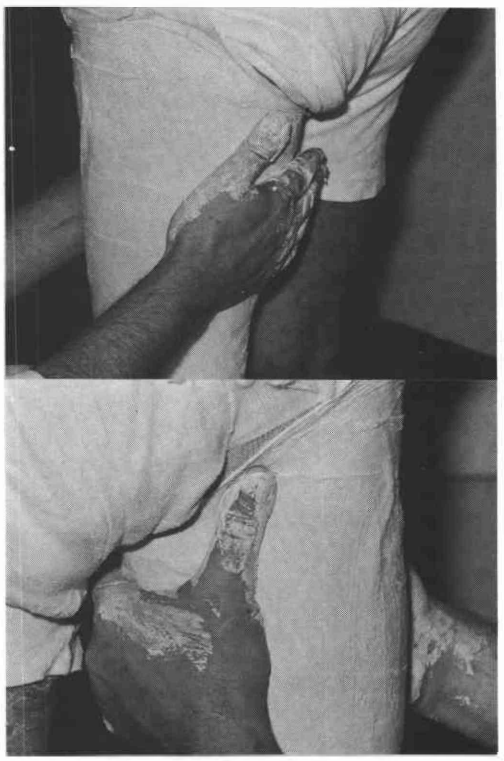

Fig. 3. Top, the posterior proximal area of the cast is flattened. Bottom, the area corresponding to Scarpa's triangle is moulded.

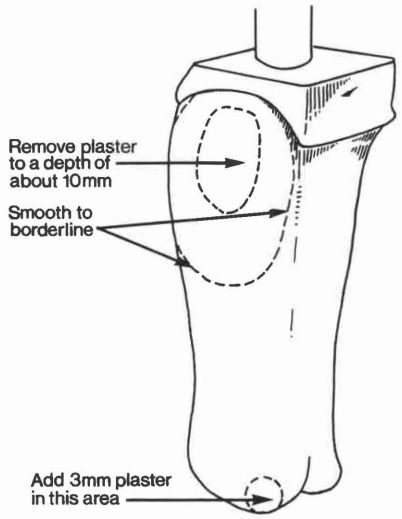


Fig. 4. Modifications to the positive cast.

function of the adductor longus as well as the rectus femoris.

Even the most perfect negative cast cannot constitute a base for a positive mould, which can be used without some modifications. First of all the mould must be smoothed to the depth of the impressions of hands and fingers. Secondly the mould must be smoothed all over.

Additional plaster must be removed on the lateral-proximal area as indicated in Figure 4— the socket having a tendency to be loose in this area.

Add 3 mm (⅛ in) to the distal-lateral-posterior area as indicated in Figure 4 in order to avoid pressure on this critical area.

The socket produced over the mould may include a soft liner or may be a hard socket with a medial window similar to the design of the Canadian Syme Prosthesis. A soft distal pad is used in the hard socket.