

A METHOD OF TAKING HIP DISARTICULATION CASTS USING HIP STICKS

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Introduction

When the Canadian-type hip disarticulation prosthesis was developed at Sunnybrook Hospital in Toronto, the cast-taking procedure was that employed for leather or metal conventional sockets which were suspended with a shoulder strap. The procedure was to apply successive layers of cotton stockinette with wet plaster smeared by hand over each layer. The spine and the crests of the ilium were marked with indelible pencil, but no attempt was made to modify the shape by hand pressure or any other means. Consequently, severe modification of the plaster positive was necessary to achieve a good fit particularly over the ilium. The amount of plaster to be removed was so excessive that a good fit depended almost entirely on the sculpturing ability of the prosthetist.

In March of 1956 Messrs. Foort and Radcliffe of the University of California in Berkeley published a report on the Canadian-type hip disarticulation prosthesis. The cast-taking method described therein employed plaster bandages in two separate stages. First, the waist band was wrapped with the patient lying face up on two tables about 1 ft. apart with the waist portion bridging the gap. Secondly, the stump area was wrapped and weight applied on a firm sponge rubber block before the plaster hardened. The method prescribed had many advantages over the sculpturing technique, but the plaster wrapping with the amputee lying on tables was not considered convenient and without extensive modification the fit over the ilium was rather loose. Since this is a critical area for suspension and since good suspension is imperative for easy toe clearance during the swing phase, attempts were made to obtain a better fit in this area without modifications. In this regard, Mr. Lucius Trautman of Minneapolis employs a string around the waist drawn tightly and downward to define the anterior aspects of the iliac crest. No doubt others have tried similar methods. This report describes the three-step method using hip sticks that has been developed at Northwestern University Prosthetic Research Center.

Socket Functions

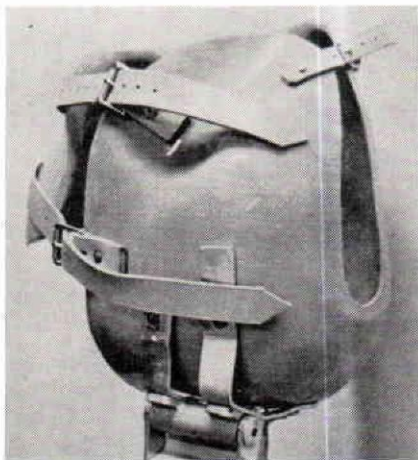
An understanding of the socket functions emphasises the important areas in the fit. There are three main functions. First, it is a seat for weight bearing during the stance phase of walking and for sitting. Second, it must provide lateral stability during the stance phase and for positioning control during the swing phase. Third, it must provide firm suspension so that toe clearance is not seriously impaired during the swing phase. It is difficult to obtain both good lateral support and good suspension in the same socket since compression of the flesh during weight bearing causes a change in alignment. This is minimal if the point of suspension is directly above the prosthesis. If an accurate fit is obtained at the ilium of the amputated side this area will act as the main point of suspension and the leg will hang vertically.

In many shops it has been customary to fit the socket well over the crests of the ilia. This tends to restrict motion and can be uncomfortable when

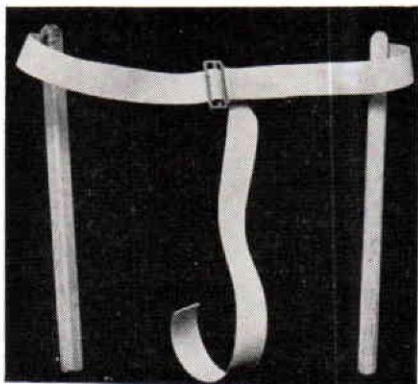
sitting or bending forward. It has been the practice at Toronto and the Research Center to fit over the ridge of the ilium between the anterior-superior spine and the top of the crest. This area provides a good mechanical grip and is essentially unaffected by torso motion. In defining this area a pair of hip sticks fastened with an adjustable web belt is employed. In addition to forming a ridge for suspension the belt holds the plaster firmly in the sacrum to provide a close-fitting flat posterior section. This is important since pressure is required in this area prior to flexing the knee just before toe-off. The hip sticks properly applied form a shelf over the anterior-superior spine thus protecting it from pressure and abrasion. The fit over the ilium is more easily maintained if a cut-out is made in the lateral wall of the socket as shown in Fig. 1 so that adjustments may be made.

The Three-Step Method of Cast Taking

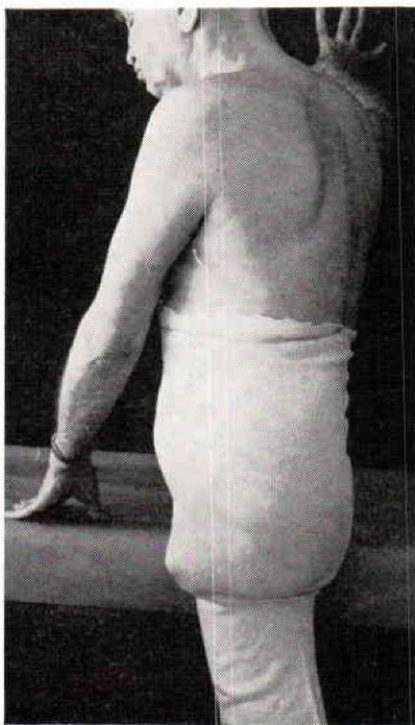
Preparation. The materials required are: examining table, plaster bandages, water, hip sticks (Fig. 2), 1 yd. of stockinette (8" or 10" wide) and string. A crutch or overhead bar is an advantage with older patients. With the amputee undressed, the stockinette is pulled on and tied with a string above the waist and at the leg. (Fig. 3.)



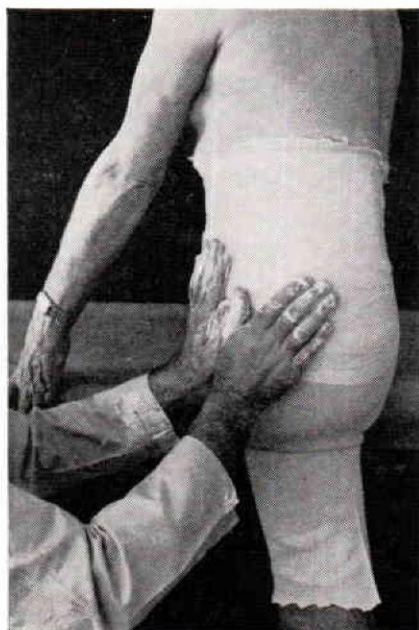
1. The Socket Read for Trial Fitting.



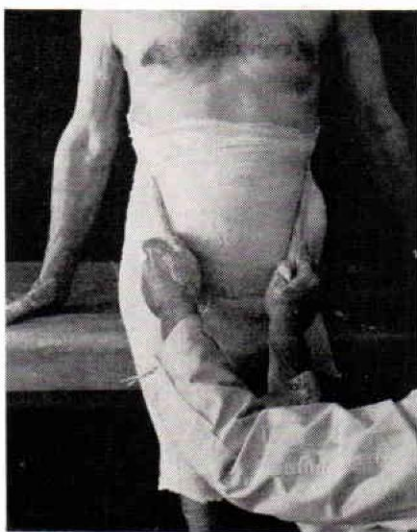
2. Hip Sticks.



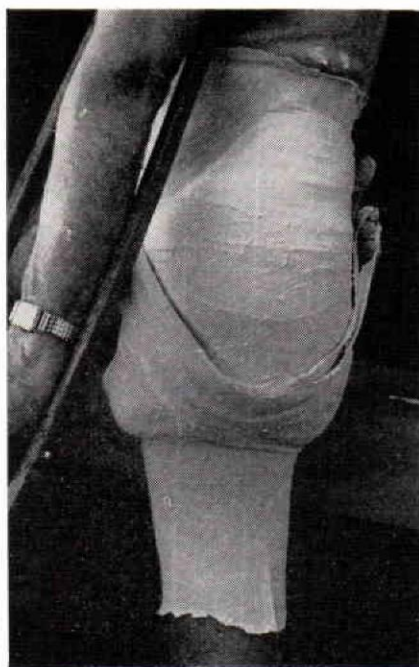
3. Cotton stockinette pulled over the stump area prior to cast taking.



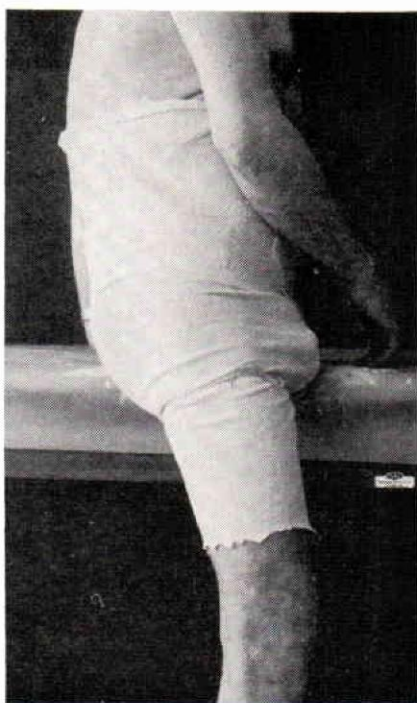
4. The waist area is wrapped with plaster bandages.



5. The hip sticks are used to define the crests of the ilia.



6. Wrapping the seat area.



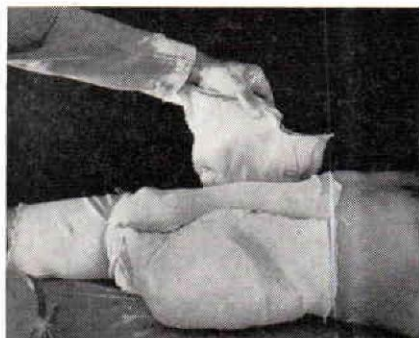
7. Forming the seat area by sitting on a table and pushing back with the good leg.

Step A. Waist Band

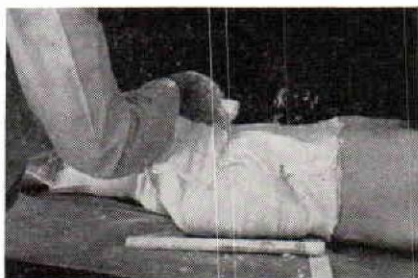
Before starting to wrap with bandages the hip sticks should be tested and the belt adjusted as necessary. While the sticks are held with one hand the area is palpated to ensure that the sticks are fitting over the ridge of bone. This is more difficult with overweight persons. The angle at which the sticks are held should be noted. (A typical case is shown in Fig. 5.) The waist area is wrapped with 2 or 3 6" plaster bandages from about 2" above the crests of the ilia to about 2" below the level of the trochanter (Fig. 4). The bandages must not be pulled too tightly lest ridges in the cast occur. Before the plaster begins to harden the hip sticks are applied in the same position as in the trial and are held until the plaster is set (Fig. 5).

Step B. Seat Area

The seat area is wrapped using 2 or 3 4" bandages with a back to front direction and the waist band is overlapped several inches to ensure a bond. (Fig. 6) Before the plaster is set the patient bears his weight on the edge of the examining table and pushes back with his good leg. (Fig. 7) This causes the gluteal muscle mass to be forced under towards the ischium providing a better seat pad and ensuring a snug fit in the posterior seat area. This position is maintained until the plaster is hard.



8. Cutting out the front section.

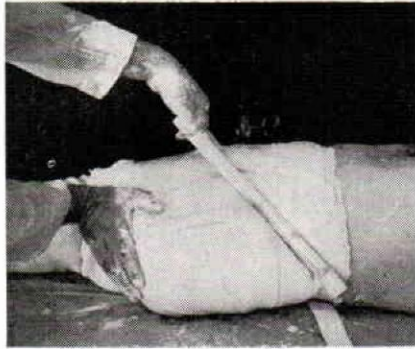


9. Laying up the front panel.

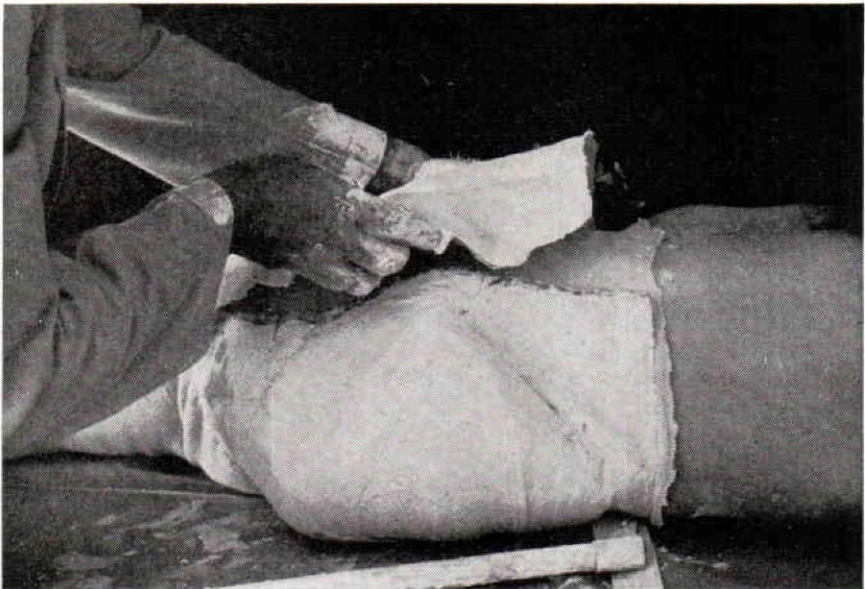
Step C. Anterior Panel

With the patient lying on his back on the table the gap that appears between the cast and the abdomen is noted. The entire front area is marked and cut out with plaster shears or a Stryker cast cutter, excluding the impression caused by the hip sticks. (Fig. 8) Vaseline is applied to the cast about 3" along the edges of the cast. Using 2 or 3 4" plaster bandages a panel is laid across the opening overlapping the original cast. (Fig. 9) Before the plaster hardens again the hip sticks are again used in the same position to draw in the cast and hold the position while the anterior distal stump area is pushed in with the other hand. (Fig. 10) The procedure is easier if an assistant is available. The new panel is keyed into the opening where the hip sticks are applied. When the plaster is hardened the front panel can be lifted off (the vaseline prevents bonding) and the rest of the cast may be removed after slitting the original stockinette from top to bottom. (Fig. 11)

The three steps outlined above require about 45 minutes to complete. Unless there are unusual scar areas or sores it is not necessary to make any marks on the stockinette or cast. Some relief may be necessary for a prominent back bone and this can be accomplished by applying a strip of felt (with thin edges) to the area before drawing on the stockinette.



10. Holding the cast securely while the front panel hardens.



11. Removing the front panel.

Pouring and Finishing the Plaster Positive

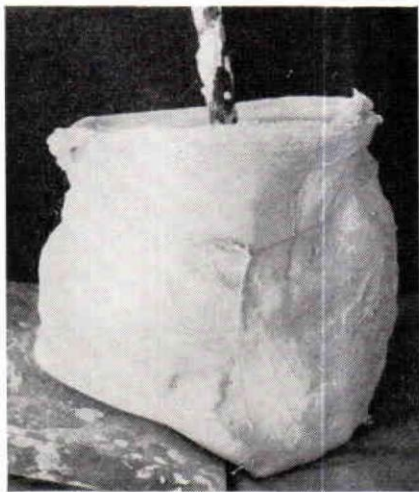
After removal from the patient the front panel is refitted to the main cast and secured with string and plaster. The stockinette is not removed, but draped over the top edge and pulled across the opening at the bottom. The bottom is further reinforced with plaster and stockinette or bandages before the positive is poured. (Fig. 12) Figure 13 shows the plaster positive after stripping the cast.

Before beginning the laminate it should be necessary only to smooth the irregular areas with wire mesh or a knife and to remove the sharp edges at the top and bottom. The webbing in the hip sticks should provide a shallow concave groove in the plaster positive. The ridge formed at the bottom edge of the groove should be removed leaving the back flat except for the concave upper edge which provides a slight flare for the top of the socket. Figure 14 shows the cast ready for laminating.

Some smoothing is usually required at the areas where the hip sticks are attached to the webbing.

If it is desired to laminate while the cast is still wet, two layers of paste floor wax may be applied followed by a dusting of water ground mica lightly over the wax.

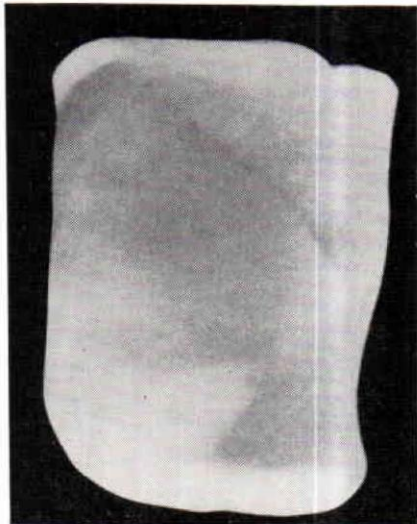
Figure 1 shows the socket ready for fitting.



12. The cast tied and plastered together.



13. The plaster positive after removal of the cast.



14. A lateral view of the plaster positive ready for laminating.

Hemipelvectomies

The preceding method can be applied to hemipelvectomies with only three important differences. Hip sticks are applied in the same way even though no bone structure is present. The keying action provides improved

suspension. The lateral cut-out is also made. The procedure differs as follows:

1. In wrapping the seat area the bandages are extended to include the gluteal area of the sound leg.
2. Before the plaster in this area is hard the amputee is asked to sit on the edge of a table with the stump area and the ischium of the sound leg both resting on the table. To do this it is necessary to push back on the sound leg as with the hip disarticulations. The position assumed is essentially an erect position with the back to the table but turned about 30° toward the amputated side. In making the socket this gluteal or ischial shelf is left protruding as far as possible and is trimmed back after fitting.
3. The cast and the socket are extended up to the rib cage so that the soft flesh in this area will not tend to extrude when weight is borne on the yielding stump. It is usually advisable to make the top edge of hemipelvectomy sockets flexible to avoid discomfort in the area of the rib cage.

Veterans Administration Uses Troy Blanket Mills' Non-Woven Synthetic Reinforcing Fiber for Better Socket and Stump Fitting in Artificial Limbs



Fred Cipolla, VAPC technician, measures and trims a length of Dacron Fiber blanket, to the dimensions of standard b/k leg mold. The blanket is then stitched to form a "sleeve."

For the past year-and-a-half, the Veterans Administration's Prosthetics Center has been using Troytuf, a mechanically interlocked Dacron fiber blanket, which makes its reinforced plastic prosthetic devices structurally stronger, easier to prepare or modify, and better fitting.

"In artificial limbs, the socket area is the most critical section because it comes in contact with the skin," points out Anthony Staros, the Center's chief. "For the sake of his comfort and the good psychological effect a wearer gets from a clean, natural appearance, the ease with which sockets can be modified and returned to their original finish is all-important. Prior to our use of this new material, we were having difficulties with laminate fillers, sometimes in their preparation, but more often when we made changes and then tried to get them back to their original finish."