

# The Body Jacket

By W. FRANK HARMON, C.O., and  
JAMES W. STANFORD, C.P.

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For years we have heard of, seen, made and used the Milwaukee Brace and modifications of this brace for the control of Dorsal, Lumbo Dorsal, and Lumbar Scoliosis in both conservative and post operative care of patients, employing the principle of distraction, pressure, and counter pressure areas to fight the devastating effects of spinal curvatures.

Too, for many years, body jackets of one type or another have been used as post-operative means of control after surgical procedures have been utilized to secure partial or maximum correction of pathological or idiopathic curvatures. They are also used extensively for other cases of paralysis, arthritis and osteoporosis.

One of the earlier products used with only negligible results was a material known as Castex. Castex, as best we can recall, was an impregnated type of bandage that was applied in much the same manner as plaster bandage, but being much thinner, the subsequent bulk encountered with plaster bandage was eliminated and the finished jacket, when cut off the mold, lacquered, and applied to the patient, was very light and only a fraction of the weight of a conventional plaster jacket or corset. There were disadvantages, though, that eliminated its continued usage.

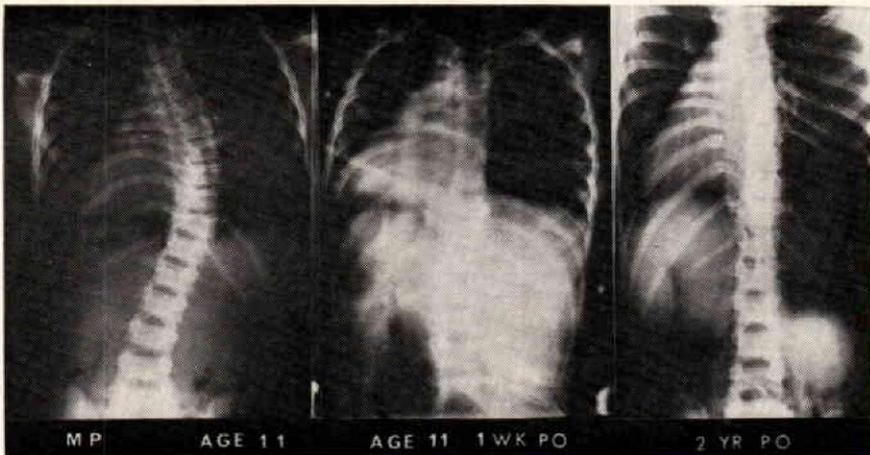


FIGURE 1—Typical scoliosis, surgically corrected, to which plastic laminated jacket was applied. (X-ray photo courtesy Darius Flinchum, M.D., Atlanta, Georgia.)

1. The cut edges and borders had a definite tendency to curl, thereby causing it to lose its original shape or contour.
2. We were unable to provide a support from Castex that would be rigid enough to give the required support and at the same time be sufficiently flexible to permit easy application and removal.

After the experimentation with Castex, we found that jackets made of Cellulose Acetate and stockinette over the prepared mold worked fairly well.

In this procedure from five to seven layers of cotton stockinette were pulled over the mold and each layer was impregnated and built up by dipping or painting with cellulose acetate before a succeeding layer of stockinette was applied. Since each layer of stockinette and acetate must dry thoroughly before the succeeding lawyer could be satisfactorily applied, the procedure was time consuming both from the standpoint of labor and elapsed time before the jacket could be cut off the mold.

After removal from the mold, it was fitted, trimmed, padded, bound, boot hooks and a metal slide tongue were added to hold the front edges in alignment.

Certain disadvantages were characteristically found in the cellulose acetate jacket. Normally, if the patient needed a permanent or semi-permanent support, this jacket would have to be replaced after an approximate year of wearing because moisture from perspiration would cause discoloration, cracking, and checking. This, combined with increased brittleness, resulted in too rapid deterioration. Labor was a highly significant factor as excessive man hours were consumed in the laminating and finishing processes.

As a result of post war experimentation by or in cooperation with research teams from the National Research Council, the Veteran's Administration and other interested personnel, the use of synthetic resins have revolutionized the materials, processes and procedures used in making the modern body jacket.

Currently the plastic laminated appliance offers many advantages over previous models supplied. By carefully controlling the mixtures of rigid and flexible resins, jackets of excellent support can be fabricated. It can be made as flexible as leather or as rigid as may be desired. The weight is moderate, certainly no heavier than the previously used cellulose acetate jacket. It will retain its molded shape or contour indefinitely without subsequent warping or curling at the edges. It is easily worked, trimmed and requires no binding or padding over bony prominences or cut edges. These edges can be rounded and polished as smooth as molded or cast glass. Moisture absorption is reduced to a minimum and the finished product can be washed or cleaned with a damp cloth. The patient can even take a shower or go swimming with this support.

A second significant factor is the labor involved. Whereas, originally, days were consumed in the lamination, fitting and finishing processes, it is now reduced to hours. The lamination can be made and the following day it can be finished and applied to the patient.

It might be advisable at this point to give the step by step procedure for the entire process.

#### **I. Cast and Mold Preparation**

1. The patient normally comes to the shop some 4 to 5 months fol-

lowing fusion of the dorsal, lumbodorsal or lumbar spine wearing the cast that was applied immediately following the surgical procedure.

This cast is removed and whenever possible a shell or negative cast, for the mold that is to be made, is made with the patient standing with cervical traction by means of an overhead suspension with a head halter with 15 to 30 pounds of vertical traction depending upon the size, weight, and condition of the patient.

2. This cast or shell is made by or under the supervision of the surgeon, and will be heavy enough to hold the plaster that will be poured to make the negative mold.

Six inch plaster bandage is wrapped with the patient under traction so that the shell will extend up under the axilla, over the breast and scapulae and down below the coccyx posteriorly and pubis anteriorly.

As soon as this has hardened sufficiently to hold its shape, it is cut down the front from top to bottom and removed from the patient.

3. Just prior to the application of the previously referred to cast or immediately following its removal, measurements are taken directly from the patient while still under traction.

Circumferences are recorded for the thorax at the nipple line, waist, crest of the ilium, and the trochanter. These measurements are followed with anterior-posterior and lateral measurements at the same torso levels.

4. The physician then applies another cast to his patient, somewhat lighter and less bulky than the original, to be worn while the jacket is being made.

5. This temporary cast or shell is closed, sealed and permitted to harden before the molding plaster is poured into the shell to make the negative mold. As the mold is poured, an iron pipe, usually 18" of  $\frac{1}{2}$ " water-pipe, is imbedded to serve as a handle or means of supporting the mold when it is being dried or being held in a vise while it is being dressed and the jacket being laminated.

6. Modifying and dressing the mold is most important.

a. The abdomen is flattened, the area from the axilla to the rib cage laterally is flattened and the excess, if any, is removed from the prominence of the buttocks. During this procedure the measurements noted above are observed and followed.

b. Frequently there will be noted on the posterior-lateral aspect of the mold, a bulge that may be from something barely noticeable to a quite conspicuous hump. This will largely depend upon the original degree of curvature and how much had been surgically corrected. *It is imperative that this bulge or hump be removed or reduced on the mold so that a corrective force will be applied in the finished jacket. The Orthopedist should*



FIGURE 2—Cast for the mold is made while the patient is in traction.

indicate to what extent or degree this is to be modified. At the same time the mold is corrected to remove excessive hyperextension.

7. The mold is now ready for an additional modification in the area of the ilium and elsewhere. To eliminate pressure over bony prominences, a layer of  $\frac{1}{4}$ " felt is fitted and cemented directly to the mold over these prominences, then the edges are skived to blend into the adjacent surfaces.

8. After the mold is modified and smoothed to satisfaction it is desirable to oven dry it before the laminating is started. If this is impossible or impractical, the mold is sealed against moisture with 3 coats of parting lacquer, allowing each coat to dry thoroughly.

## II. Laminating the Jacket

The success of this new plastic laminating technique depends upon a properly shaped mold and a thorough knowledge of the laminating procedures, and best results are obtained by the use of a vacuum system in the fabrication technique in order to assure that the finished jacket will follow the exact contours of the mold.

It may take some experimentation on your part to determine the degree of rigidity or flexibility required for a particular individual. We, however, have found that as the size of the mold is increased the thickness and rigidity of the jacket must also be increased proportionately. For a child age 4-7, 5 layers of stockinette is sufficient and the resins would be mixed 60% Flexible to 40% Rigid: ages 8-14 (average weight) may require 6 layers of stockinette and a 50-50 mixture of flexible and rigid resins, while a large adult may require 7 layers and 50-50 mixture or even 55% rigid to 45% flexible.

1. Drill two holes, approximately  $\frac{1}{8}$ " diameter in the pipe that protrudes about 12" above the brim of the mold. The first hole will be  $1-1\frac{1}{2}$ " from the brim and the second one,  $1-1\frac{1}{2}$ " distal to the first hole. These holes or Air Vents will be used with the vacuum equipment.

2. Pull one cotton stockinette over the mold. This will serve the dual purpose of insuring a smoother finish on the inside of the finished jacket and serve as an escape route for air inside the inner PVA bag.

3. Pull one dampened PVA bag over the cotton stockinette to serve as a separator between the mold and the plastic resins.

4. Tie off the PVA bag below the proximal air hole that has been drilled in the pipe. Test this PVA bag with the vacuum as it is imperative that the bag follow the exact contour of the mold or a poorly fitting jacket will result.

5. Apply three (3) lengths of nylon stockinette over the PVA bag and tie them off below the distal air vent.

6. Lay up strips of  $\frac{1}{2}$  or 1 oz. dacron felt (4 to 7" wide) over the posterior and/or lateral sections of the jacket that will require reinforcement for strength and rigidity. Severe scoliotic cases with excessive concave or convex exterior alignment will require considerably more reinforcement than fully corrected or normally aligned backs.

7. Pull on 2 to 4 additional nylon stockinettes, depending on size of mold, and tie them off below the distal air vent.

NOTE: In selecting size of stockinette, a rule of thumb guide may be as follows:

22" to 27" Hip circumference—4"- 5" stockinette  
28" to 32" Hip circumference—5"- 6" stockinette  
32" to 36" Hip circumference—6"- 7" stockinette  
36" to 40" Hip circumference—8"-10" stockinette  
Rarely will there be occasion to use 12" stockinette

8. Pull a second (outer) dampened PVA bag over the top layer of stockinette and tie it below the distal air vent and again check the vacuum. This should pull all layups snugly into any undercuts of the mold and assure an exact reproduction of the mold contours.

9. Polyester plastic resins are used in the laminating process. These are mixed in the heretofore mentioned proportions. The total weight of the mixture will vary from 1500 to 2600 grams depending on the size of the mold and the number of layers of stockinette to be impregnated.

To this mixture add 3% ATC Luperco Paste, 3% Naugatuck No. 3 promotor, and 2%-3% pigment as desired.

Mix and blend thoroughly. This formula allows approximately 20 minutes working time before the plastic jells.

10. Pour the plastic mixture in the area between the two PVA bags and turn on the vacuum (8 to 15 in. lbs. depending on size of jacket).

11. Work the plastic into the nylon thoroughly making sure that the plastic is evenly distributed and that all air is driven from the bag and no air pockets remain. A nylon cord used as a "stringing" tool will aid in this operation.

12. After the nylon is saturated, evenly distributed, and all air removed, gently heat the jacket with a heat gun. Keep the heat gun in motion to prevent concentrations of heat in any area. This heat will speed up setting or jell time and not allow the plastic to be sucked up into the vacuum pipe or tube.

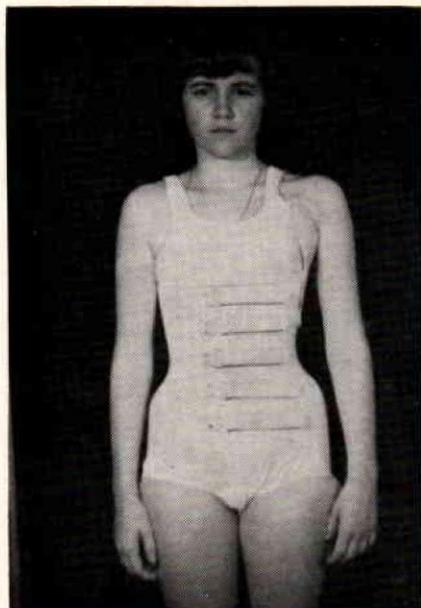


FIGURE 3—Anterior view of plastic laminated jacket.

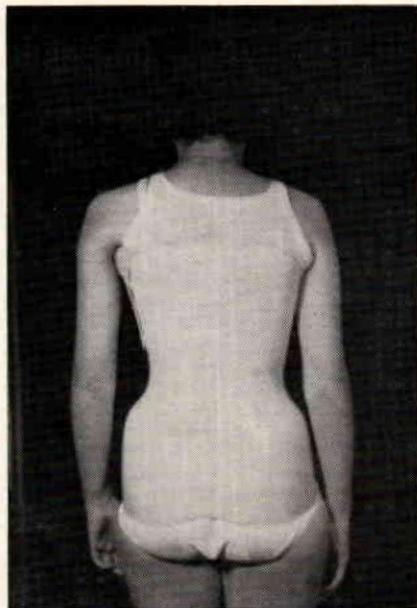


FIGURE 4—Posterior view of plastic laminated jacket shown in Figure 3.

13. The vaccum can be turned off after the resins have set and the lamination should be allowed to "bench cure" 24 hours or at least overnight before it is removed from the mold.

14. To remove from the mold, cast saw cuts to release the top and bottom sections are made above and below the top and bottom margins of the finished jacket. An anterior vertical cut from top to bottom will now allow easy removal, and the inner and outer PVA bags will slide off.

The temporary cast, applied and worn while the jacket was being made, is removed and the new jacket placed around the patient and secured by an ordinary belt while the patient is lying down. Preliminary marks are made on the jacket with a grease pencil to mark the top and bottom margins. At this point of the fitting it is frequently impossible, because of the height of the jacket, for the patient to assume the sitting position.

After the preliminary trimming, usually done with a cast saw, the patient is brought to a sitting position and again the jacket is carefully marked for additional trimming to afford maximum comfort while sitting.

Normally the top margin of the jacket is left as high as practical, particularly in the back, coming up well above the inferior margin of the scapulae. The front of the jacket is normally trimmed below the nipple line of male patients and below any breast prominence of the female.

While trimming, it is highly advisable to avoid taking off too much at any one cut, since, once removed it cannot be made higher or lower. For this reason, we pursue the trial and error method and will frequently make as many as three or four cuts rather than take the chance of cutting away too much in any one cut.

Once the jacket has been made comfortable to the patient's tolerance, all edges are rounded and polished to a smooth glossy finish. Straps are then attached, using Velcro rather than conventional buckles. The Velcro is less bulky, easier to fasten and loosen, and will be quite effective.

When finished the patient is advised regarding the wearing and removal of the jacket and told that he or she can take a shower or go swimming without undue damage to the appliance. The patient is then referred back to the doctor who, in most instances, will have additional X-Ray pictures made with the jacket in place for record purposes.

## **CERTIFICATION EXAMINATION DEADLINE**

**Candidates for Certification are reminded**

**that July 1, 1965 is the deadline**

**for application for the**

**1965 BOARD EXAMINATIONS**