TRACY (E.A.)

A BRIEF SPLINT-TECHNOLOGY FOR SURGEONS.

BY

EDWARD A. TRACY, M.D.,

OF BOSTON;

FELLOW OF THE MASSACHUSETTS MEDICAL SOCIETY.

FROM

THE MEDICAL NEWS,

March 17, 1894.

[Reprinted from THE MEDICAL NEWS, March 17, 1894.]

A BRIEF SPLINT-TECHNOLOGY FOR SURGEONS.[1]

BY EDWARD A. TRACY, M.D.,
OF BOSTON;
FELLOW OF THE MASSACHUSETTS MEDICAL SOCIETY.

THE objects of this paper are to treat in detail of a new material and method devised for surgical splint-making; to aid the surgeon to become the maker of suitable splints for cases occurring in practice; and to indicate lines of procedure in apparatus-making that promise rich results in general and orthopedic surgery.

THE MATERIAL.—The basis of the material employed is wood-pulp, made preferably from the crushed fiber of the poplar tree, and rolled in such fashion that the broken fibers intertwine in every direction and loosely, so that an increase of plasticity is thus given to the product. These sheets are further strengthened by having a fabric introduced between the layers of the pulp, or by interweaving with the short, crushed wood-fiber, a long ute or other tough fiber.

The sheets are rolled of different thicknesses, for adaptability to all splint-conditions. For convenience I shall designate the thickness by number, each unit representing a thickness of one millimeter;

[1] An abstract of a paper read before the first Pan-American Medical Congress, at Washington, 1893.

thus, sheet 1 represents the material with a thickness of one millimeter; sheet 2, with a thickness of two millimeters, and so on.

CHARACTERISTICS OF THE MATERIAL.—The chief characteristics of this material are stiffness or rigidity when dry, and plasticity when moist. Its rigidity can be increased *ad libitum* by the use of a silicate solution as a moistener. Its plasticity has a limit. The limit is rarely experienced and only when molding the material over certain complex curved surfaces. To exemplify: A splint cannot be directly molded over the ankle-joint anteriorly, for there are two large curves in opposite directions to be followed simultaneously, the convex curve from malleolus to malleolus, and the concave curve from above downward over the leg and instep. This difficulty, when met, can be obviated in various ways. I shall mention three of them. Take the case of the ankle-joint: An anterior splint is required for it. The proper-shaped blank should be cut from sheet No. 1 and moistened with one of the solutions to be described later. It should then be applied to the limb, care being taken to keep its outer border in contact with the skin, while the superfluous material over the anterior aspect of the joint should be pinched between the thumb and forefinger, and all of it laid or pressed over to one side; a bandage should be snugly applied to perfect the molding of the splint. (This method of "pinching and folding over" has an important application in the making of spinal jackets.) A second way consists in cutting away the superfluous material, in this case an elliptic figure, and bringing the edges of

the cut portion together, and so retaining them by means of a strip of the material pasted over the cut edges. A third method is to cut a blank for each important curve and, after molding, to properly unite them.

Besides the foregoing characteristics, the material possesses that *desideratum* of a splint-material—extreme lightness. Its cheapness also deserves a passing mention.

MOISTENERS.—Water or a stiffening solution can be used to moisten the material. The advantage of water is its omnipresence. A serviceable splint can be made with its help. Such a splint should be protected from perspiration or other moisture, lest it be softened and its usefulness destroyed. It can be so protected by a covering of oiled paper or silk, by mackintosh, or best by a coat of varnish.

A stiffening solution, with several qualities to recommend its use, is that of silicate of potassium; silicate of soda is almost as serviceable. Any desired degree of rigidity can be imparted to a splint by using this solution—the amount of rigidity depending on the strength of the solution. A splint rendered rigid in this manner is not affected by perspiration, or indeed by momentary contact with fluids, as in washing. Another advantage, especially in cases of compound fracture, is that this solution renders the splint antiseptic.

In practice, the solution of silicate of potassium generally sold for surgeons' use, and further diluted with water, can be employed. The commercial solution is regarded as a 100 per cent. solution, and the percentage solutions spoken of in this paper are

to be made by diluting the commercial solution with the proportion of water called for by the percentage; thus a 70 per cent. solution is made by mixing 70 parts of the commercial solution of silicate of potassium with 30 parts of water. The commercial solution should have a specific gravity of from 1.3 to 1.4.

Another useful stiffening solution is that of dextrin, in the proportion of about ℥viij to Oj of water. This solution adds some tenacity, besides stiffness, to the material treated with it. A splint made with its aid can be remoistened with water and remolded—quite an advantage in cases in which, from disappearance of swelling or other cause, a closer approximation of splint and limb is desired. In practice, dextrin (to be had of paint-wholesalers) can be carried in powder form, and a solution in water extemporized when needed. (An addition of 8 gr. of corrosive sublimate to Oj of the dextrin solution will render it antiseptic.)

Moistening Process.—A few descriptive words should be added concerning the proper manner of moistening the material. The aim should be to get barely sufficient moisture into the material to render it semiplastic. If more moisture be absorbed, it becomes more difficult to maintain the molded splint in the desired shape while drying, and it also unnecessarily lengthens the time required to dry the splint. I find the best manner of moistening the splint-blank is to apply the fluid used, on each side of it, alternately, by means of a flat paste-brush. A little practice will enable one to judge

the precise amount of moistening best suited for the purpose.

Drying. — The time required for drying the molded blank varies, for the different sheets employed, from ten to forty minutes; the thicker sheets, holding the more moisture, require a longer exposure to heat. Any source of sufficient heat can be employed; a good kitchen fire is very efficient and, generally, convenient. While the splint is drying it is serviceable to have yarn or string wound around the moistened form after its removal from the body, to aid it to maintain the desired form, until permanent drying fixes it.

I shall briefly consider the application of splints to the human body, under the headings—

1. Head splints.
2. Trunk splints.
3. Upper limb splints.
4. Lower limb splints.

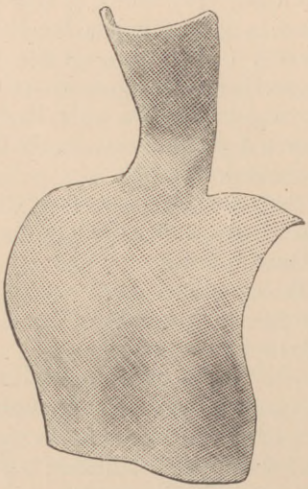
This simplicity of classification will necessarily be violated in specific cases in which compound splints, embracing parts of different systems, are constructed.

[The following four descriptions are selected from the original paper for illustration in this abstract.]

1. A Cervical Spine Splint.—This splint is devised for fixation of the cervical vertebræ. The blank is cut from sheet No. 2 or from sheet No. 3, according as the case is that of a child or an adult. The head of the patient should be supported in the desired position while the moistened blank is being molded over the back, shoulders, neck, and occiput; the molding is facilitated by the use of a

gauze bandage applied snugly over the blank. After a short retention the molded blank should be removed and dried. The neck-piece can be reinforced if desired. The complete splint is pictured in Fig. 1.

FIG. 1.



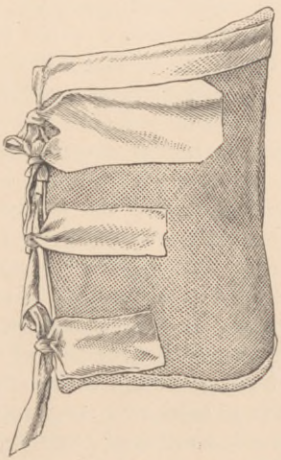
A cervical spine splint.

2. A SPINAL JACKET.—I shall here briefly suggest a technique for a simple, cheap, and serviceable jacket.

The blank is to be cut from sheet No. 1 and moistened with a 75 per cent. solution of silicate of potassium. This blank is of the simplest pattern, being sufficient to envelop the patient's body, once

and a quarter around, and its width governed by the amount of spine we desire to control. The needful trimming of the blank can be done upon its first application to the body. The patient should be placed in the same position as for the application of a plaster jacket; he should have on him a

FIG. 2.



A spinal jacket.

tight-fitting woollen undershirt. The blank is to be applied to the body by commencing on the front about two inches beyond the median line, and keeping that portion in place, guiding the rest of it around the body so as to overlap considerably in front. A vertical line should be drawn on the overlapping piece, from the armpit; the object of this

line is to give position to the hinge-joint which we require in the jacket to facilitate removal and re-application. The joint is made by bending the moistened blank backward and forward along this line until the pulp is sufficiently broken—the fabric imbedded in the sheet forming the hinge. After drying the jacket, this hinge should be strengthened by gluing strips of chamois skin, one inch wide, over the hinge, inside and outside.

The blank having been applied to the body as described, we proceed to make it conform to the body-surface as accurately as possible. We place over the spines a large pad (two large rolled bandages, each four inches in diameter and six inches long, placed end to end, do well), which serves to press the blank well into the hollow of the back. Further conformation to the body is obtained by the "pinching and folding over" method described. Here this method is particularly advantageous, for it adds threefold to the vertical strength of the jacket, without a material increase of its weight. A gauze roller-bandage should be so applied over the whole blank as to hold it in snug apposition to the body. After a few minutes' retention the bandage should be taken off and the jacket carefully removed; in doing so the hinge described should be made use of, so as to disturb as little as possible the form imparted to the jacket. If the blank has been properly moistened, but slight aid to hold its form need be given to the jacket, till drying permanently fixes it. Thus, the foundation for a good spinal jacket is completed. It can be reinforced as desired. Straps can be fastened to it for its adjustment,

or lacing bands can be applied to it for the same purpose. Fig. 2 illustrates a spinal jacket which was molded on and worn by a boy of six years. The binding and fasteners are made of chamois skin, glued by means of a cheap liquid glue directly to the jacket. The hinge-joint is here omitted, the natural resiliency of the material sufficing for the removal and reapplication of the jacket. The jacket was made at the child's home in about forty minutes.

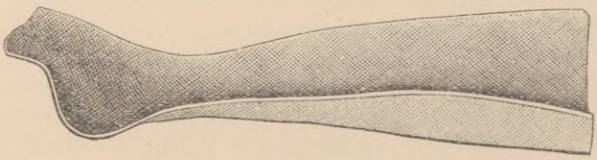
3. A PALMAR FOREARM SPLINT.—This is a very simple but important splint. It meets the indications that Cheever emphasizes in the treatment of a Colles' fracture. That accurate surgeon says: "The important point would seem to be . . . . . not to press the back of the wrist down in such a way, by splints, that we shall lose sight of this arch, which is so marked, under the radius. . . . . This arch must be well supported. . . . . The splint should terminate at the head of the metacarpal bones, and the thumb and fingers should be left free.[1]"

The position of the forearm for the splint pictured in Fig. 3 was that of semi-pronation; that of the wrist, semi-extension—its natural position of rest. The pattern should slightly overlap the ulnar side of the forearm, so that there will be sufficient material in the blank to be molded over that side of the forearm. The blank should be cut from sheet No. 1 and moistened carefully with a 75 per cent. solu-

[1] Lectures on Surgery. By David W. Cheever, M.D. See Lecture X. Boston Medical and Surgical Journal, vol. cxxix, p. 2.

tion of silicate of potassium. The blank should be applied to the palmar surface of the forearm, so that the ulnar side is overlapped by the blank. The blank should then be carefully molded over the forearm in the position described. After snugly applying a roller bandage over the splint, commencing at the wrist, then enrolling the hand, and finally the arm, pressure should be applied by squeezing the forearm and splint between the thumb and fingers at a point one inch and a quarter above the styloid process of the radius, where the arch of the

FIG. 3.



A palmar forearm splint. (Right, viewed from radial side.)

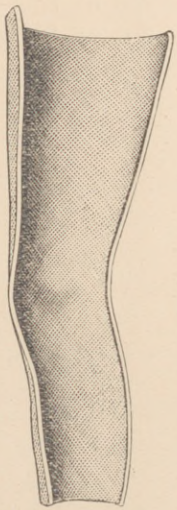
radius is most pronounced. The direction of the pressure, it need hardly be mentioned, is from the palmar to the dorsal side of the forearm; its object is to give the splint an arch approximating that of nature. After squeezing in the manner described for a moment, the splint should be removed and dried. A side or radial view of the completed splint is pictured in Fig. 3.

The curve of the splint caused by the arch of the radius is there imperfectly illustrated. The curve of the splint, made by molding the overlapping por-

tion of the blank over the ulnar side of the fore-arm, is important, because it is the main source of the strength of this splint.

4. A LATERO-POSTERIOR KNEE SPLINT.—This splint is for fixation of the knee-joint. It is a modi-

FIG. 4.



A latero-posterior knee splint. (Left.)

fication of the so called ham-splint. It differs from the ham-splint in having a surface that is applied to the lateral surface of the limb (preferably the inside), as well as to the posterior aspect. This addition greatly strengthens the splint and aids its fixation. The blank should be cut from sheet No.

2 (sheet No. 3 for a very powerful limb), and moistened with a silicate solution. The blank should be applied to the limb so that the portion corresponding to the shaded part of the pattern lies over the internal aspect of the limb. The molding of the splint is perfected by applying a roller bandage snugly about it; after a moment's retention to the limb the splint should be removed and dried. A completed splint for the left knee is pictured in Fig. 4.