MATERIALS AND EQUIPMENT FOR IMMEDIATE POSTSURGICAL PROSTHETICS

As a service to those who have purchased the manual "Immediate Postsurgical Prosthetics in the Management of Lower Extremity Amputees" by Burgess, Traub, and Wilson, the following current listing of sources of materials and components is presented. This listing, prepared by the Prosthetics Research Study of Seattle, Washington, updates Appendix D of the manual.

Those who do not own the manual but wish to purchase it may do so by writing to the Superintendent of Documents, Washington, D.C. 20402. The cost is 45 cents.

The EDITORS.

Since the preparation of the manual, Immediate Postsurgical Prosthetics in the Management of Lower Extremity Amputees, the Prosthetics Research Study has been aware of the need to develop an updated materials and equipment list. With this supplement, this has been accomplished. The list includes not only recommended materials and equipment but some sources of supply, instructions for sterilization of Orlon/Lycra Stump Stockings, and a reprint of an article on the "Technical Aspects of Plaster of Paris," by the Johnson & Johnson Co.

PROSTHETICS RESEARCH STUDY,
Seattle, Washington

IMMEDIATE POSTSURGICAL PROSTHETICS INSTRUMENT KIT

The purpose of this kit is to gather together all necessary equipment and materials in a professional manner to easily perform each step in the procedure of Immediate Postsurgical Prosthetics Fitting. The kit can be purchased by hospitals, surgeons, and prosthetists, and can be maintained at all times from the office of the individual professional involved, or from the hopital central supply.

Each article in this kit should have a receptacle for ease of storage and a professional look. All hand tools should be plated or be of bright metal to facilitate sterilization.

The kit should include the following:

Hand Tools

6 in. bandage scissors.
Slipper spoon.
8 in. screwdriver.
9/16 in. open end wrench.
Tube cutter—1 3/4 in. maximum opening with built in reamer.
6 in. pliers.
Reamer for deburring 1 5/8 in. aluminum tube (optional).
3/8 in. and 5/16 in. Allen wrenches brazed together.
Skiving knife, 6 in. thin flexible blade.

12 in. metal rule.
8 ft. Lufkin "Mezurall" stainless steel rule.
M–5 "Bulldog" metalmaster Weiss shears.
7 in. side cutters (optional).
3/16 in. and 5/32 in. Allen wrenches brazed together.
Plumb bob.
8 in. plaster shears with serrated cutting edges.
Two deep socket wrenches (special for VAPC pylons) (optional).

Materials

Four rolls of elastic plaster bandage.
Four sterile stump stockings.
Two SACH feet in shoes.
Dow Corning spray Adhesive Type B.
One right, one left below-knee waist belt.
One above-knee suspension belt.
Two sets of cables with housing—22 in. cable 15 in. housing; 18 in. cable 11 in. housing.
Two sets of below-knee felt patches, right and left.
One each above-knee and below-knee adjustable pylons with socket attachment straps.
One piece of 5 in. tubular cotton stockinet 18 in. long.

Container should be standard 20x17x7 travel bag adapted with receptacles for all above tools and materials.

Two PRS above-knee casting fixtures right and left.

SOURCES OF SUPPLY OF SPECIAL MATERIALS AND EQUIPMENT

Orlon/Lycra Stump Socks

Bennington Stump Sock Corp.
2400 Merrick Road
Bellmore, New York 11710

The Knit Rite Company
1121 Grand Avenue
Kansas City, Missouri 64106

The United States Mfg. Co.
P.O. Box 110
Glendale, California 91209

K & K Prosthetic Supplies, Inc.
2436 Ocean Avenue
Bellmore, New York 11710

Southern Prosthetics Supply Co.
P.O. Box 7443
Atlanta, Georgia 30309

"Elastic" Plaster-of-Paris Bandage—"Ruhrstern" (3, 4, 5, and 6 in. width)

Fillauer Surgical Supplies, Inc.
P.O. Box 1678
Chattanooga, Tennessee 37401

The Knit Rite Company
1121 Grand Avenue
Kansas City, Missouri 64106

K & K Prosthetic Supplies, Inc.
2436 Ocean Avenue
Bellmore, New York 11710

"Elastic" Plaster-of-Paris Bandage "Orthoflex" (2, 3, 4, and 5 in. width) (Johnson & Johnson)

A. J. Hosmer Corp.
P.O. Box 37
Campbell, California 95008

Southern Prosthetics Supply Co.
P.O. Box 7443
Atlanta, Georgia 30309

The Knit Rite Company
1121 Grand Avenue
Kansas City, Missouri 64106

The United States Mfg. Co.
P.O. Box 110
Glendale, California 91209

Local surgical supply

Dow Corning Medical Adhesive Type B

K & K Prosthetic Supplies, Inc.
2436 Ocean Avenue
Bellmore, New York 11710

The Knit Rite Company
1121 Grand Avenue
Kansas City, Missouri 64106

The United States Mfg. Co.
P.O. Box 110
Glendale, California 91209

Southern Prosthetics Supply Co.
P.O. Box 7443
Atlanta, Georgia 30309

Local surgical supply

PRS Above-Knee Casting Fixtures

K & K Prosthetic Supplies, Inc.
2436 Ocean Avenue
Bellmore, New York 11710

Southern Prosthetics Supply Co.
P.O. Box 7443
Atlanta, Georgia 30309

The United States Mfg. Co.
P.O. Box 110
Glendale, California 91209

PRS Above-Knee Suspension Corset and Cables

K & Prosthetic Supplies, Inc.
2436 Ocean Avenue
Bellmore, New York 11710

The S. H. Camp Company
Birmingham, Michigan 48012

Southern Prosthetics Supply Co.
P.O. Box 7443
Atlanta, Georgia 30309

The United States Mfg. Co.
P.O. Box 110
Glendale, California 91209

Pre-Cut Below-Knee Felt Patches and Below-Knee Suspension Belts

The United States Mfg. Co.
P.O. Box 110
Glendale, California 91209

Immediate Postsurgical Prosthetics Instrument Kit

The Knit Rite Company
1121 Grand Avenue
Kansas City, Missouri 64106

Southern Prosthetics Supply Co.
P.O. Box 7443
Atlanta, Georgia 30309

The United States Mfg. Co.
P.O. Box 110
Glendale, California 91209

SACH Feet [a]

A. J. Hosmer Corporation
P.O. Box 37
Campbell, California 95008

Kingsley Mfg. Company
1984 Placentia Avenue
Costa Mesa, California 92626

K & K Prosthetic Supplies, Inc.
2436 Ocean Avenue
Bellmore, New York 11710

The Knit Rite Company
1121 Grand Avenue
Kansas City, Missouri 64106

Otto Bock, Inc.
219 Fourteenth Ave., N.
Minneapolis, Minnesota 55411

Southern Prosthetics Supply Co.
P.O. Box 7443
Atlanta, Georgia 30309

The United States Mfg. Co.
P.O. Box 110
Glendale, California 91209

Lambs Wool

K & K Prosthetic Supplies, Inc.
2436 Ocean Avenue
Bellmore, New York 11710

Southern Prosthetics Supply Co.
P.O. Box 7443
Atlanta, Georgia 30309

Local surgical supply

The Knit Rite Company
1121 Grand Avenue
Kansas City, Missouri 64106

The United States Mfg. Co.
P.O. Box 110
Glendale, California 91209

Above-Knee Adjustable Pylon—Friction Knee—Hydra Knee [a]

The United States Mfg. Co.
P.O. Box 110
Glendale, California 91209

Below-Knee Adjustable Pylon [a]

A. J. Hosmer Corporation
P.O. Box 37
Campbell, California 95008

Pope Brace Company
197 Southwest Avenue
Kankakee, Illinois 60901

The United States Mfg. Co.
P.O. Box 110
Glendale, California 91209

The Knit Rite Company
1121 Grand Avenue
Kansas City, Missouri 64106

Southern Prosthetics Supply Co.
P.O. Box 7443
Atlanta, Georgia 30309

[a] These devices are tested yearly to meet VA specifications and only certain ones are approved for use by the VA for a particular year.

RECOMMENDED STERILIZATION PROCEDURE

For Orlon/Lycra Stump Stockings to be used in Immediate Postsurgical Fittings

The following procedure is recommended for American Sterilizer Company Gas Autoclaves only. Should another system be used, local assistance should be obtained to determine proper procedure.

1. Autoclave setting:
   Temperature—130 deg. F.
   Pressure—15 p.s.i. (regular) to 5 p.s.i. (plastic)
   Initial vacuum—20 inches of mercury
   Humidity—30—50 percent
   Jacket steam pressure—3#
2. Sterilant used:
   Oxyfume Sterilant 12
3. Orlon/Lycra stump stockings can be sterilized in large lots in their original cartons at 130 deg. F. with 7 p.s.i. pressure, with a 570 sterilant concentration for 6 hours.
4. Aeration time:
   24 hours
5. Each article should be individually packaged in sealed polyethylene bags to avoid storage contamination.

TECHNICAL ASPECTS OF PLASTER OF PARIS [b]

During the past century plaster of paris has become the most universally used material for immobilization. Other materials have had temporary acceptance but none has possessed all of the ideal characteristics of plaster.

In spite of this widespread acceptance, there is surprisingly little in current medical literature of the physical and chemical properties of plaster of paris. This booklet has been prepared with the hope that it will prove useful in understanding the properties and limitations of plaster casts.

Manufacture

Plaster of paris is manufactured from a solid crystaline material known as gypsum or calcium sulphate dihydrate. Gypsum is pulverized to break up the crystals and then subjected to intense heat to drive off most of the inherent water of crystallization. The resulting powder is plaster of paris. Chemically, this may be diagramed as follows:

$2CaSO_4.2H_2O$	$(CaSO_4)_2.H_2O + 3H_2O$
(GYPSUM)	(PLASTER OF PARIS)

[b] Reprint of an article published by Johnson and Johnson.

The Setting Process

When water is added to plaster, the above reaction is reversed and the plaster recrystallizes or "sets" back into solid gypsum. A definite heat of crystallization occurs simultaneously and is the equivalent of the heat required to decompose the original gypsum. (See Thermal Effects.) Long, thin crystals form rapidly and interlock closely—and it is this tight interlocking that gives plaster much of its ultimate strength. *However, if the plaster is disturbed by excessive molding or bending during the time when plaster is going from a fluid to a solid state, short stubby crystals, only loosely interlocked, are formed and a weak flabby cast results.*

Plaster requires more water to bring it to a "fluid," workable state than is needed chemically to satisfy its requirements in setting. The crystals that form in the setting process are about 20 percent water of crystallization, but several times this amount of water may be present in the fresh cast. After the cast sets, this excess water must disappear by evaporation from the surface before the cast can attain its maximum strength. After it has dried there will be air voids between the crystals in the cast with the same volume as the water which has evaporated. These air voids are what make a cast porous and permit air to reach the skin through the cast.

Thin casts may dry completely in several hours but thick ones may require as much as a week or more. The rate with which this evaporation takes place will vary with the humidity, temperature, and circulation of air around the cast. Casts may appear dry on the surface and yet contain considerable water in their deeper layers.

Thermal Effects

The chemical reaction which takes place when plaster is combined with water to recrystallize back into gypsum is an exothermic one—that is, it gives off heat. This evolution of heat is not very noticeable in thin casts. But in overthick casts the temperature rise may be enough to cause the patient apprehension and, under extreme conditions, actual damage to the skin. These conditions are to some extent within the control of the person applying the cast because, while the quantitative amount of heat produced by a given amount of plaster is a constant figure, the maximum temperature reached will vary with the techniques of application and conditions surrounding the individual cast. The thicker the cast, the higher the maximum temperature reached. Bandages with faster setting time will reach a higher temperature than bandages with a slower setting time. Generally speaking, the higher the room temperature and humidity, the higher the temperature rise, and naturally the dipping water temperature is the base upon which all of these other factors build. Therefore, what might appear to be an insignificant difference in water temperature might become very significant after 40 deg. F. to 50 deg. F. have been added to it.

One of the most important factors in this situation is the amount of ventilation or free circulation of air around the cast. *Over-wrapping the freshly applied cast with an elastic bandage, placing it on a pillow or mattress, covering it with a blanket or otherwise insulating the cast from free access to the air, causes a sharp increase in temperature rise. Conversely, the most effective way to reduce the temperature of a cast is to increase circulation of air, such as by blowing air over the cast with a circulating fan.* This increases the evaporation of excess water and evaporation consumes heat and therefore has a cooling effect.

There appears to be no indication that variations in the formulation of a plaster bandage have any marked effect on temperature rise; i.e., the heat of crystallization is a constant factor with all plaster of paris. Under identical conditions, various brands and formulations of bandages all reach the same temperature level. Most casts will reach maximum temperature in 5 to 15 minutes after application and then begin to cool off almost immediately.

Setting Time

Most plaster bandages and splints today fall into one of two categories as far as setting-time is concerned—fast-setting (5 to 8 minutes) and extra-fast-setting (2 to 4 minutes). This time is measured from the point at which the plaster is wetted to the point at which the cast has become firm. The "built-in" setting-time may be modified by outside factors. Warm saturation water will hasten setting while cool water slows it up. Using a bandage "sloppy-wet" will delay setting while wringing it dry will hasten setting. Various accelerators (potassium sulphate, common salt) or retarders (sodium citrate, borax) may be added to the saturation water to adjust setting, but the addition of these foreign materials may have a deleterious influence on cast strength. Saturation water should be changed frequently or the plaster residue in the pail will act as an accelerator.

Cast Strength

The initial strength of a freshly applied cast is very important. A cast that is strong enough to withstand the stresses and strains to which it is subjected during this early "green" period will almost certainly be more than strong enough when dry because the strength of a cast increases steadily as the excess moisture dries out. Each layer of plaster material applied to a cast should be rubbed into the layers below to avoid delamination. The less water carried into the cast in each bandage, the quicker the cast will dry and acquire maximum strength. Drying occurs rapidly when the cast is exposed to warm, circulating, dry air, but is slow when the cast is kept covered or when the air is moist.

Almost any outside ingredient or adulterant added to plaster has a weakening effect on the cast. For example, the addition of a relatively small quantity of a smoothening agent to increase the creaminess of a bandage

will decrease cast strength up to 25 percent. The major exception to this finding is the resin-plaster bandage where the addition of a synthetic plastic resin substantially increases cast strength.

The Hazards of Overthick Casts

Plaster casts should be made as thin as the required degree of strength, rigidity, and immobilization will permit. A light thin cast is obviously more comfortable for the patient and, in fact, may hasten recovery by permitting more ambulation and exercise.

The more plaster put into a cast, the longer it will take to dry out and acquire ultimate strength.

The thicker the cast, the more difficult becomes the task of removal.

As described previously, the thickness of a cast has a direct relationship to the amount of heat generated. Caution is urged, therefore, when extra-thick casts are deemed essential, to take every step to minimize other factors involved in the evolution heat.

X-rays will be clearer and sharper when taken through a relatively thin cast.

Casts ¼ in. thick will usually develop sufficient strength for satisfactory immobilization of most fractures, and thicker casts are rarely necessary. When plaster splints are used, 5 to 8 plies are usually adequate. It should be borne in mind that whenever casts exceed these suggested limits of thickness, the difficulties and hazards described previously are more likely to occur.

Saturation and Application

Plaster bandages should be saturated in water at room temperature (70–75 deg. F.). This is warm enough to avoid chilling the patient. The use of warmer water will accelerate setting time, provide a higher temperature base for a subsequent rise in temperature, and may cause excessive plaster loss by loosening the adhesive agents which bond the plaster to the fabric. The bandage should be held loosely and submerged vertically for five seconds. Keeping the thumb under the forward edge of the bandage will eliminate any possible difficulty in locating the starting-end after saturation.

The excess water picked up in saturation should then be expelled by squeezing. Some brands of bandages must be handled more carefully than others to avoid excessive plaster loss. The less water carried into the cast in each bandage, the quicker the cast will dry and acquire maximum strength.

In applying bandages to the patient, a moderate rubbing of the successive turns or layers of each bandage into the layers below will help to form a solid well-fused cast. In moving a patient with a freshly applied cast, care must be taken to avoid possible distortion of the cast during the "green" period immediately following application.

Storage and Rotation of Stock

Plaster is a material that will readily absorb moisture. If exposed to sufficient moisture, the bandage will become "pre-set" and unfit for use. Therefore, all plaster materials should be stored in a dry place. Resin bandages are also vulnerable to heat and should not be kept near steam pipes or radiators.

Under normal storage conditions, plaster bandages will remain perfectly usable for five years or more. However, they do not improve with age and stocks should be rotated so that older material is used first.