AN INSULATING PLASTIC COAT FOR NEUROSURGICAL INSTRUMENTS

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(Received for publication May 18, 1955)

In the neurosurgical operating room the use of high frequency, high voltage, electrical current for prevention of bleeding, coagulation of bleeding points, or coagulation of isolated nerve roots or residual tumor tissue is standard practice. Often the working area is cramped, as in a tumor bed or in the posterior fossa, and short-circuiting between instruments and tissue is annoying and may be dangerous—normal tissue may be burned, coagulation does not occur when desired, and adjacent nerves or roots may be affected by spread of the current.

To prevent such short-circuiting Greenwood1 developed a very effective bipolar forceps, which has been modified by Scoville.2 Various protective sheaths of rubber, bakelite, polyethylene, etc., have been suggested but all are limited in actual use. Some are rough or too thick; others will not stand autoclaving; none can be applied to instruments of varying shapes or contours with equal effectiveness.

Any material used as an insulating coating for surgical instruments should have a high dielectric strength and arc resistance, be resistant to average wear in the operating room, stand repeated autoclaving for either long or short periods, and be flexible enough to allow the instruments (such as a suction tip) to be bent within limits. It must be fairly easy to apply and not prohibitively expensive.

The plastics field offered the best starting point in searching for such a material. Most plastics were eliminated “on paper” because of poor or undesirable electrical and physical properties. The remaining few were tested in the operating room. Of these KEL-F® was the most satisfactory. This plastic is a polymer of trifluoro-chloroethylene, characterized by the formula (CF₂—CFCl) X. It has a dielectric strength of approximately 1200 V/mil and an arc resistance greater than 360 seconds. After proper application it forms a hard, non-porous film which absorbs no moisture and resists ordinary wear. Coated instruments now in use have been autoclaved over 100 times and the coating still shows no tendency to chip or peel and continues to retain all its insulating quality. One of the test objects, a Steinman pin, was autoclaved for 7 hours straight without any obvious change in the plastic coating. The coating is flexible enough to allow any reasonable alteration in instrument shape and it can be applied to almost any irregularly contoured surface (Fig. 1).

KEL-F® is relatively expensive (about $43 per gallon of dispersion) and for best results should be applied with a spray gun by an experienced worker. In practice all instruments are cleaned by heat or sand blasted and coated with a primer after masking all areas to be left uncoated. The primer is fused to the metal by heating for 1 hour at 480°F. Three layers of plastic are then applied with a baking period of 1 hour at 480°F. between applications. After the final coat the layers are fused to each other and to the instrument by baking for 16 hours at 480°F. The resulting

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* Manufactured by Chemical Manufacturing Division, M. W. Kellogg Company, P.O. Box 469, Jersey City 8, N. J.
plastic coat is an effective insulator even when used with an electrocoagulating current twice the strength normally used in the operating room. The coat is smooth, hard, non-porous, and lasts indefinitely with repeated autoclaving and normal use.*

KEL-F® is not indestructible. Coated instruments should be wrapped separately for autoclaving or cold sterilization. They should not be mixed indiscriminately with other instruments which may chip the coating.

REFERENCES

2. SCOVILLE, W. B. Personal communication.

* All experimental work was done in conjunction with American Durafil Co., 2500 Washington St., Newton Lower Falls, Mass. Instruments to be coated may be sent directly to this company with instructions for marking area to be left uncoated.