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Short report

Plastination – A Novel Method In Tissue Preservation

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ABSTRACT

The traditional method of teaching and research in Anatomy and Pathology use mainly specimens fixed in formalin and ethyl alcohol for the demonstration of gross tissue specimens. However, some of the limitations as regards preparation, storage, handling and disposal of these specimens have resulted in the introduction of this new method of tissue preservation called plastination which improves the handling, storage qualities and durability of these teaching and research specimens.

Key Words: Plastination, Polymerizable resins, and Elastomers , Cured and Uncured Polymer, Intermedium, Impregnation.

Plastination is the impregnation of biological specimens with polymerizable resins and elastomers by utilizing differences in their vapour tensions or pressure (Von Hagen, 1979a).

This technique was developed to aid research and educational programs (Von Hagen, 1976; Bickley, 1980). This is used in demonstration of gross tissue specimens, which forms an important component in the teaching and research in Anatomy and Pathology. There have been some limitations and difficulties experienced during preparation, storage, handling and disposal of teaching and research materials used traditionally in the teaching and research in Anatomy and Pathology (Danborono, et al; 1997). This new method greatly improves the handling qualities and durability in which the tissue water is removed and replaced by cured polymer (Von Hagen, 1979a; Von Hagen, 1979b), either in bulky or thin tissue specimens.

METHOD

Tissues are prepared in a similar manner to that used for paraffin impregnation. Tissues may be fixed in formalin but that is not essential (Von Hagen, 1979a; Von Hagen, 1979b).

Dehydration is done with alcohol, ethylene glycol or acetone. The tissues are then saturated with an intermediary solvent, which is exchanged subsequently for the resin (Knebel, 1979). The intermediary solvent must have low boiling point i.e. with high vapour pressure and should be freely miscible with the resin to be used for its replacement. Most widely accepted and useful intermedia are methylene chloride (dichloromethane) and acetone (Von Hagen, 1979a; Von Hagen, 1979b; Bickley, 1980).

The specimen is the fully immersed or impregnated in container of uncured resin and the volatle intermedium allowed to evaporate by slowly decreasing the ambient pressure. As the solvent boils out of the tissue, an equal volume of the resin is substituted. This is done under low temperature to avoid polymerization (Von Hagen, 1979a; Knebel, 1979). When the exchange is completed, the specimen is rinsed and removed to room temperature to allow the resin to cure.

Though, theoretically, any number of thermosetting resins and elastomers could be used for impregnation but in practice, certain specimens combined with specific variations of the basic procedure to give the most desirable physical and optical properties when properly matched to the tissue. For example, a whole solid organs and thick sections including the brain for complete impregnation using epoxy-silicone copolymer. Thin-walled and unusually flexible specimens like the lungs, the intestinal tract for incomplete impregnation with silicone rubber. Bulky organs with fine details or with thin walls like the heart, cystic kidney or nerve dissections for complete impregnation with silicone

rubber while thin transparent sections of about– 5um for complete impregnation with epoxy or polyester (Von Hagen, 1979; Von Hagen, 1979b).

The epoxy-silicone copolymer is a mixture of clear epoxy and transparent solicone rubber that emulsifies as curing progresses. The hardened resin consists of a continuous epoxy and a discontinuous silicone incorporated as tiny gellated miclelles (Von Hagen, 1979b; Bickley and Von Hagen, 1980; Knebel, 1979).

DISCUSSION

For some decades now, the teaching of Anatomy and Pathology has remained traditional or routine teaching methods use mainly specimens fixed routinely in formalin and ethyl alcohol for the demonstration of gross tissue specimens in the teaching and research in anatomy and pathology. This traditional method has shown some limitations in the preparation, storage, handling and disposal of such materials.

This new method of impregnation of biological specimens with a number of curable polymers, in which tissue water is removed and replaced with cured Polymer, called plastination (Von Hagen, 1979b; Bickley and Von Hagen, 1980), an innovation that have greatly improved the handling, qualities and durability of these teaching and research specimens.

The method allows the cured polymer to appear white because of total reflection given to the tissue. The optical properties of the cured emulsion has high light transmittance with complete dispersion (Von Hagen, 1979b), which allows transparency of the finished specimen with colours and structural details present at the surface to be easily observed (Bickley and Von Hagen, 1980; Danborono, et al, 1997).

The method can be modified to suit specific need of individual tissues and users. These modifications come under sheet plastination use for thin sections of lungs, incomplete impregnation with silicone rubber for thin-walled and flexible specimens (Knebel, 1979; Danborono, et al; 1997). While some bulky and large specimens require reimpregnation called double impregnation with the same polymer or a different polymer.

Plastinated specimens have been shown to be of better and superior quality to those specimens preserved in formalin and has been introduced in the teaching and research in Anatomy and Pathology Departments in Europe and America (Bickley and Von Hagen, 1980; Danborono, et al; 1997). This could be vigorously introduced in Nigeria and rest of Africa for improved teaching and research in areas of Anatomy and Pathology.

REFERENCES

Bickley HC, Von Hagens G, An Improved Method for the Preservation of Teaching Specimens. Journal of Medical Education, 1980

Danborono B Hamman WO, Singh SP and Sheriff EM Why Anatomical Education has remained traditional in Nigeria. Paper presented at West African Anatomical Society at University of Jos, Jos, Nigeria, April 2-5.

Knebel R, Plastination Eines Fishes, Eines Herzens and Eines Schulter Blattes Der Preparator **25**:51-56, 1979.

Von Hagens G, Impregnation of Soft Biological specimens and thermosetting Resins and elastomers. Anat. Rec. **194**:247, 1979a.

Von Hagens, G: Emulsifying resin for Plastination. Der Praeparat, 25: 43, 1979b