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CESSATION OF THE POSTMORTAL BIOLOGICAL FACTORS EFFECTS BY PLASTINATION PROCEDURES

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ABSTRACT. Decay is a vital process in nature but an impediment to morphological studies, teaching, and research. Many scientists tried experiments for anatomical preservations in the ages. Plastination is developed by Dr. Gunther von Hagens in Heidelberg, Germany in 1978. In this process, water and lipids in biological tissues are replaced by curable polymers which are subsequently hardened, resulting in dry, odorless and durable specimens.

KEYWORDS. plastination. biological factors, Biodur

INTRODUCTION

Anatomy is a fundamental educational science in Medical Universities. Usually we use natural anatomical preparations for practical learning of human and animal morphology. They are made from bodies of dead humans and animals. The biological material has a quick destruction. This is a great problem for the modern anatomy.
Physical and chemical changes begin in tissues of organisms after their dead. Decay is a vital process in nature but an impediment to morphological studies, teaching, and research. This is a big difficult for preservation of the bodies and for anatomical education. All organic compositions destroy irreversible by the action of microbes and proteolitic enzymes. Part of microbes enter in the body from surroudings after dead because the protection is absent. Saprophytes are constantly in cavities of organism. They both saprophytes and putrides activate and develope in the tissues since there are proper conditions for their development - nutrition and humidity. It has always been a goal to find suitable preservation techniques, especially for anatomists.

Many scientists tried experiments for anatomical preservations in the ages. The first preparations are related with religion. Priests in Peru, Chilie, Egypt, Tores Strait islands near Papua New Guinea used different physical and chemical factors for cessation of destruction process (Aufderheide, 2003). In the Middle Ages European anatomists used chemical combinations for tissue impregnation. They griped destruction action of microbes and tissue enzymes (Gwinn et al., 1991).
Mayer (2000) defines the modern balsamation which is based on watter formaldehyde solution as chemical fixation of cell proteins. Formaldehyde responds to soluble albumins in cells and reduces them to albuminoids or gel. At once it destroys microbes and protects the cadaver.

GOAL AND PURPOSES

The goal of the present investigation is to determine a sufficient effective, accessible, unexpensive, applicable and safty physical or chemical factor for permanent conservation and durable preservation of biological material for educational needs.

MATERIAL AND METHODS

We used the Plastination method - Biodur S10 technique for our investigations. The S10 technique is the standard technique in Plastination. Specimen Impregnation with S10 results in opaque, more or less flexible, and natural looking specimens. The procedure consists of the four main steps of Plastination, besides the specimen preparation and dissection before.

Fixation

Fixation can be achieved by all usual fixatives as formaldehyde solution, Kayserling solution etc. Hollow organs must be dilated during fixation as well as during dehydration and gas curing.

Dehydratation

Dehydration removes the specimen fluid, as well as some fat. In this step tissue fluid is replaced with an organic solvent. Either alcohol or acetone may be used as a dehydrant for Plastination. Acetone is used in most cases because acetone also serves as the intermediary solvent during the next step - forced impregnation. To minimize specimen shrinkage, dehydration is done in cold (-15°C to 25°C) acetone. If the removal of fat is also desired the dehydrated specimen must be kept in acetone at room temperature for some time. An acetone amount of 10 times the specimen weight is best for good results. Dehydration is finished when the water content is less than 1%.
Equipment: deep freezer (explosion proof or motor and compressor removed and placed in a different room), acetonometer (to measure the content of water).

Impregnation

Forced impregnation is the central step of Plastination. In this step the intermediary solvent (acetone) is replaced with a curable polymer (BIODUR® S10). The silicone polymer S10 is mixed with a curing agent BIODUR® S3 (1 part S3 and 100 parts S10) which commences the process of end-to-end linkage of the molecules (Henry, 1995a). This linking is enhanced at room temperature, however, it is very slow when

kept in the freezer at -15°C to -25°C. The dehydrated specimen is submerged in the cold 8-15 °C to -25°C) polymer mixture. After some days of immersion, vacuum is applied to it. Vacuum is increased gradually to boil the intermediary solvent (acetone), which has a lower boiling point (+56°C) out of the specimen. Impregnation is monitored by watching the bubble formation on the surface of the mixture and by a vacuum gauge. Vacuum is complete when the pressure is around 5 mm Hg. Equipment: deep freezer (explosion proof or motor and compressor removed and placed in a different room), vacuum chamber (e.g. Heidelberg plastination kettle), vacuum pump (with a pumping speed of 1,5 m3/min. for 15 l polymer mixture or 3 m3/min. for 30 l polymer mixture)

Gas-curing

Finally the polymer inside the specimen has to be cured (hardened). This is achieved by exposing the impregnated specimen to a gaseous hardener (BIODUR® S6). S6 is a liquid that vaporizes at room temperature (Henry, 1995b). The impregnated specimen and a bowl filled with S6 is placed in an tightly closed chamber for several weeks. To keep the environment for curing dehumidified a bowl with a desiccant (e.g. calcium chloride) is also placed in the curing chamber. To enhance the curing procedure air may be bubbled through the fluid S6. For complete curing inside the specimen the specimen should be kept in a plastic bag for several weeks.

RESULTS AND DISCUSSION

Cessation of the postmortial biological factors effect is possible by a plastination procedure. We get a safty, durable, unexpensive, accessible and sufficient effective speciment is after plastination procedure. It is rough and ready for educational needs. Biological specimens do not shrink considerably and do not and decay when exposed to normal atmospheric conditions.

Plastination is developed by Dr. Gunther von Hagens in Heidelberg, Germany in 1978. In this process, water and lipids in biological tissues are replaced by curable polymers (silicone, epoxy, polyester) which are subsequently hardened, resulting in dry, odorless and durable specimens.

There are a variety of different plastination methods available. Each has advantages and disavantages and yeilds specimens with different characteristics. The class of polymer used determines the optical (transparent or opaque) and mechanical (flexible or firm) properties of the impregnated specimen.

CONCLUSIONS

Plastination is a unique technique of tissue preservation. Plastinated specimens retain textures and structures of tissue and are therefore an invaluable teaching resource in anatomy. Plastinated specimens have none of the usual hazards and restrictions associated with the study of anatomical specimens eg. use of gloves, toxic fumes, contagions etc, and are more robust than the original specimen.

Silicone is used for whole specimens and thick body and organ slices to obtain a natural look. This technique is proper for anatomical preparation for education needs.

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