TRAINING IN PLASTINATION

Jacob Gimongo a senior technologist at the department went through a training in plastination at the School of Anatomical Sciences in the Faculty of Health Sciences of the University of the Witwatersrand, Johannesburg, South Africa from the 23rd Feb. to 22nd May, 2015. The aim of the training was to enhance Technical skills in specimens preparation using the plastination technique and to compare the benefits of using plastinated specimens over use of wet specimens. Prof. Amadi O. Ihunwo gave the introductory remarks to Plastination history then, now and way forward for institutions of higher learning.

The participants for the training were: Mr. Jacob Gimongo from Nairobi, Kenya, Dr. Blessing Uzokwe Chioma and Mrs. Jackyline from Nigeria, and Ms Stacy Lander from South Africa. The design of the training was to be hands on following the valuable practical guide by Mr. Jacob Mekwa and provision of the requirements just in time for a successful training.

The advanced technique was invented by Gunther Von Hagens in Heidelberg, Germany in the year 1977 and has since become a valid preservation method of anatomical specimens for teaching and research worldwide. Different methods of plastination were highlighted and include the silicone method, epoxy method and the polyester method respectively. Silicon method of plastination was preferred during the training and the chemicals used included: formalin, acetone, silicone polymer, S3 (catalyst), S6 (gas cure) and methylene chloride.

Prepared human materials from body donors were used for the plastination training. The choice of the materials was based on the size of the impregnation chamber, volume of the silicon available and the size of the specimens that would perfectly fit into the chamber. Two set of specimens were used for plastination during the training. Set one had the following: 2 hearts, 1 surgital section of head, 1 ankle joint, 1 thigh-femora triangle, 1 trunk. In the second set of specimens we had: Head and neck, median section of head, knee joint, ankle joint and the leg

Purification of the used acetone was ideal for re-use as recycling of the same would save a lot on cost of procurement. With patience, enough acetone was recycled for re-use using the available distillation apparatus in the laboratory. The room design for acetone steps has all sources of fire relocated to a safe place outside the room. Explosive proof lighting system has been fitted with electrical outlets and the freezer motor fitted outside the room. The room has adequate extraction and is well equipped for possible spillages.

PLASTINATION COMPONENTS

1. Fixation/preservation
2. Dehydration and defatting
3. Forced impregnation
4. Curing /hardening

FIXATION/PRESERVATION

Two set of specimens due for plastination had been preserved in formalin and set aside for the training exercise on plastination techniques.

RINSING AND DISSECTION

The specimens in both sets were washed in running tap water for two days with the aim of neutralizing the formalin/preservative fumes during dissection.

During the initial stages of plastination, Prof. Amadi O. Ihunwo further dissected the specimens to expose the structures that were to be displayed.

DEHYDRATION AND DEFATTING /DEGREASING

Tissue water and lipids were removed by subjecting the specimens to at least three changes of acetone bath at one-week interval in every change. Acetone is preferred because it is a successful dehydration agent, defatting/degreasing agent and an intermediary solvent which is able to mix with all types of resin used in plastination. Acetone can also be recycled for reuse.

Changes between the acetone baths was to be swift so that the specimens doesn't dry in between changes as this would adversely affect the quality of the specimens.

The specimens were turned/agitated at least once a day so as to ensure maximum action of the acetone on the specimens. Acetone turns yellow when fats are removed. Degreasing would be considered complete when the acetone bath remains clear.

FORCED IMPREGNATION

Forced impregnation was to replace the volatile intermediary solvent of acetone using biodur mixture of S6 and S3 in the ratio of 100:1. The mixture was degased before putting the specimens into it.

Upon submerging the specimens into the silicon mixture they were allowed to rest for between 24-48 hours to stabilize before sealing the vacuum chamber and allowing the impregnation to proceed at -25^{o}C.The vacuum gets the reaction mixture of silicone inside the specimen.

The pressure was allowed to lower slowly after warming up the pump to maintain a steady flow of small bubbles as acetone boils from the specimens. The vacuum causes acetone to change from its liquid phase to vapor phase which ultimately escape as vapor aspirated by the vacuum pump.

This process was done under vacuum in a deep freezer at -25^{o}C for two weeks. The process was monitored on each working day for optimum exchange rate of acetone for silicone during the impregnation of the specimens.

PRE-CURING

Upon stopping the impregnation process the specimens were removed from the deep freezer chamber and allowed to drain of excess polymer.

The specimens were wiped using a cloth, wrapped in polythene papers and then stored in a cabinet at room temperature for one week until they become tacky (viscous reaction)

Prof. Amadi O. Ihunwo guided in the exposing, identifying and aligning of the Anatomical structures which were fixed with the help of wires, pins and blocks. Soft tissue was used to fill up the gaps in hallow spaces and vessels.

GAS CURING USING BIODUR S6

Curing of the specimens was done in a well-ventilated room using biodur S6 gas in fish tank with an absorbent cloth/toweling to permit excess silicon to drip free from the specimen or be absorbed from the surface. Vaporization was enhanced by bubbling air through an aliquot of S6 using a membrane pump to supply adequate air flow within the chamber.

S6 is a gas cure liquid containing silicate with a high saturated vapor pressure (boiling point $70 – 80^{O}C$). Small volume of S6 was used on day one and two respectively to help minimize the amount of white precipitate that would otherwise form on the cured specimens.

The S6 commences a three dimensional cross linking (side to side linkage) of molecules and hence impart toughness or firmness to the specimen. Curing begins from the surface of the specimen and seals the surface hence decreases oozing of polymer from the specimens. The S6 continuous to diffuse deeper into the specimen towards the center until the specimen is totally cured. S6 was allowed to evaporate from the specimens in the open environment.

SUMMARY

1. The specimens were dry and easy to handle after plastination.

2. There were no formalin fumes experienced on the dry specimens (devoid of harmful effects)

3. The specimens are ideal for museum or display and ready for teaching

4. Plastination can accommodate a variety of specimens from gross specimens, dissected specimens and cross section slices and therefore ideal as an alternative method of specimens' preparation for teaching and research in institutions of higher learning.

5. The training achieved its goal in the time allocated.

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Prof. Amadi O. Ihunwo, Head Morphological Anatomy, Wits University, South Africa

Mr. Jacob Mekwa, Wits University

All Anatomical Sciences staff, Wits University