

## UTILIZATION OF FORMALIN EMBALMED SPECIMENS UNDER ECO-FRIENDLY CONDITIONS BY ADVANCED PLASTINATION TECHNIQUE

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### ABSTRACT

Preparation of anatomical models and teaching aids is a challenging task in the medical, veterinary and paramedical sciences as like as life form. The successful preservation of conventional methods by embalmed cadavers/ corpse's are routinely practiced for educational/research purposes. The existing form of preservation technique is not promising to meet the current challenges in the teaching and learning of human/veterinary anatomy. The embalming fluid causes potential health hazards with continuous exposure of formalin fumes. The study was conducted on dissected cadaverous embalmed specimens by using advanced plastination technique. The 10% formalin fixed and preserved specimens of buffalo head and horse limb were subjected to dehydration, impregnation and hardening with clearing, dehydrating and curing agents. Plastination methodology consists of slowly replacing tissue fluids, lipids with a dehydrating agent and replaced with polymer under force impregnation. In these processes, water and lipids in biological tissues are replaced by curable polymers. The yielded specimens are pleasant to handle, non toxic, pliable, dried and don't smell or decay. These plastinates are well utilized in routine practical demonstrations of gross anatomical observations in institutional teaching as well as learning. The plastinated specimens are today's milestone in medical education and become an ideal teaching tool not only in anatomy but also in pathology, obstetrics, radiology and surgery. Hence, any methodology or technique that would decrease the level of exposure to formaldehyde should be explored. Plastinates offer this excellent alternative as it lowers the risk of undue exposure to formaldehyde with higher health and safety regulations in our country.

**KEY WORDS:** Embalmed specimens, anatomical techniques, plastinates, formaldehyde and impregnation.

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### INTRODUCTION

Many preservative methods have been in place of thousand years to help with the decomposition of the body. Mummification is the one of the oldest preservative technique and popularly known as mummies were prepared and preserved in pyramids by Egyptians. In 1896 formalin was introduced for cadaver preservation.

There after, scientists were developed color preserving embalming fluids/solutions to preserve life like color appearance and flexibility to aid in the study of the body. In 1925, the embedding medium paraffin wax impregnation was introduced. However, 1960's the organs/human bodies were prepared by plastic polymers/or polyester resins. In recent

past years, the whole human bodies/cadavers were preserved by cryo-preservation method which involves the cooling of the body to very low temperature for preserving the body/organs. The most challenging eco-friendly anatomical technique is plastination and more than hundreds of laboratories in world wide adapted for preparation and preservation of anatomical teaching aids or museum models in the 21<sup>st</sup> century [1]. The cadavers are the only source of teaching tools in the human and veterinary anatomy and handled regularly by the staff and students in the anatomical laboratory. The embalming fluid causes potential health hazards with continuous exposure [2]. The anatomists are try to find out new alternatives to overcome the various health hazards during handling of embalmed cadavers in institutional teaching of medical and veterinary sciences. The cadavers should be eco-friendly nature during demonstration and handling with safety levels of individual health.

**Principles of Plastination:** To follow the standard anatomical dissection procedure, this includes the removal of the skin, fatty and connective tissues. Individual anatomical structures to be prepared by using standard anatomical dissection tools in order to remove skin, fatty connective tissues. Further decaying process should be halt and prevent by pumping embalming solution formalin in to the body through the arteries. The dissected and formalin fixed anatomical specimens to be placed in the solvent chemical bath like acetone to remove the water and fat soluble fats form the tissues. Further, the anatomical specimens are placed in vacuum chamber and also immersed in curable reactive polymers like silicone rubber. During forced impregnation the curable reactive polymers replaces the vaporized acetone under vacuum conditions and aids to polymers permeate in to the cell. Slowly, the body cells have been saturated with reactive /curable plastics. Then the specimens are subjected into curing or hardening. Depending on the polymers curing have been done with presence of gas, light or heat. The prepared anatomical specimens are properly aligned and fixed with half of wires, needles, clamps and foam blocks [1].

## MATERIALS AND METHODS

The study was conducted on the formalin preserved cadaverous specimens. The specimen was collected from the postmortem case from the department of Veterinary pathology, Navsari Agricultural University, Navsari, Gujarat. These specimens were preserved in the 10% formalin and dissected out as per standard dissection procedure to understand the different layers of muscles, tendon and ligaments. The sagittal section of buffalo head and longitudinal section of horse limb were taken instead of preserving years together in the embalming tank after the dissection practices and demonstration in the undergraduate laboratory. It subsequently, 3-4 changes had given at 4 days interval in acetone for dehydration. The clearing and impregnation was done with 1:1 ratio of chloroform and melamyne solution for 4-5 days. Then, 2-3 changes had been given in same ratio of solution at 4 days interval in same mixture. Further, the limb specimen was subjected to the curing process by soaking in 9:1 ratio of melamyne and hardner for 4 days [3]. Finally they were shadow dried without exposing to direct sunlight.

## RESULTS & DISCUSSION

It was observed that the plastinated specimen was more pleasant to touch and easy handling for demonstration of superficial and deep layers of tendons, ligaments and muscles and bones (Fig. 1 to 3). There were many advantages in palatinates over formalin preserved specimens/ handling of wet specimens [4]. However, the plastinated specimens are for teaching anatomy and pathology is well known [5 &6]. The formalin fixed specimens are effectively utilized and preserved in eco-friendly conditions.

**Fig. 1:** Plastinates of horse limb (Longitudinal Section).



**Fig.2:** Plastinates of buffalo head (Sagittal Section).



## CONCLUSION

The plastination is an alternative method to meet the current requirement of teaching tools/aids in the anatomical laboratory of medical institutions across the country. Animal welfare organizations and ethical committees raised their curiosity to find out the new footstep in biological tissue preservation. Plastination is a good anatomical technique which is increasingly gaining popularity for its own benefits in teaching and research of anatomy both medical and veterinary field. It might be promising to preserve the biological life on our planet especially endangered and significantly extinct species to show to next generation.

**Conflicts of Interests: None**

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