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Plastination

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Abstract:
Plastination, developed by Gunther von Hagens in 1977 is described as a technique to preserve bodies or body parts in anatomy. During this process, the water is replaced by certain plastics that can be easily touched and do not cause decay, and even retain most properties of the original sample. Plastination is therefore, been proved to be very useful in anatomy as well as serving as models in teaching tools, plus, several educational and research purposes.

Key words:
Plastination, preservation, cadavers, silicon, curable polymers.

INTRODUCTION:

Plastination is fundamentally, a technique of tissue preservation that was introduced eight years ago, with the aim of obtaining a dry, odourless and a durable specimen. The procedure involved in plastination consisted of four steps – fixation, dehydration, forced impregnation in a vacuum and hardening. Some of the curable polymers used in this process include, silicone, epoxy, polyester resin, etc. Among these polymers, polyester resin has been used for the production of opaque brain slices, while epoxy resins are used for transparent body or organ slices **[1].**

This review is intended to give a concise awareness of plastination and the various techniques administered; besides plastination on few human body parts. Finally, the benefits and drawbacks of this process have also been mentioned along with the conclusion. The techniques and processes described in this article, gives us a brief idea of what the actual process of it is in the laboratory **[1].**

Plastination is a very beneficial study method that is increasingly gaining popularity for its benefits in teaching and research of anatomy.

PLASTINATION TECHNIQUES

PLASTINATION BY THE POLYESTER POLYMER:

Figure 1: Plastination of a dolphin

A new method of sheet plastination of the specimens were mainly applied for the preservation of tissue slices for a dolphin, and this was done by making use of a polyester polymer. This method also provides material for the study of sectional anatomical structures, which is based on the technology for tissue preservation that has been improved by researchers, to produce and improve final product. In this experiment, a Cape Dolphin's cadaver was taken, on which a new polyester sheet plastination technique was performed.

Towards the end of the experiment, the cut tissue slices of the body of the dolphin were cured in a heated water bath and finally exhibited detailed anatomical information **[2].**

PLASTINATION BY THE SILICON POLYMER:

For silicon plastination process, the most significant is the specimen preparation; especially when fresh tissue is being incorporated. In order to highlight vessels, intravascular injection of coloured silicon, gelatine, latex or epoxy maybe used, and each one of these has distinct benefits. Among these, epoxy has the ability to fill even the smallest vessels, however brittle it is in nature. After diluting the epoxy mix, up to forty percent of methyl – ethyl ketone or acetone maybe added. The other products remain flexible but may not reach the capillary bed. During the process, hollow organs need to be flushed, cleaned, dilated and then fixed in a dilated state, since dilation of hollow organs will increase the flexibility of the organs due to the thinner wall. Even dilation pressure should be carefully noted and regulated, since over dilation can result in the distortion of anatomical presentation **[3].**

PLASTION WITH FORMALIN:

The use of formalin was believed to be incorporated in plastination technique as a source of material, since there was scarcity of organs and also the choice of specimens resulted from decreased organ and body supply. However, some of its advantages include its handling capability which is done with ease; it also makes very good preservation and formaldehyde frees specimens with the possibility to expand these techniques to other research related fields, like paleopathology and forensic medicine. Therefore, it deals with specimen treated with formalin and alcohol based fixatives, which are being currently utilised as the source for specimens to plastinate. The resultant plastinated specimens include the heart, forearm, kidneys, spleen, entire brain and hemispheres **[4].**

REUSE OF ACETONE IN PLASTINATION:

The cost of acetone used during the dehydration step has been considered to be an important factor in the process. To allow the reuse of acetone a three-step method has been employed – in the first step, the contaminated acetone is stored in the freezer separating congealed fat by filtration; the second step consists of vacuumed distillation of the acetone and is conducted with a vacuum pump that is found in any plastination laboratory. About 95-97 percent of pure acetone has been produced at the end of it. The final step involves taking away the residual water from distilled acetone that brings the purest form of acetone, about 99.5 percent. Towards the end, vaporised acetone that is released during the impregnation step of plastination is recaptured **[5].**

PLASTINATION OF HUMAN PARTS

HEART PLASTINATION:

Figure 2: Plastinated heart

Plastinated hearts that are preserved firmly are said to be natural specimens, fixed in a dilated state, in which the water and fats are replaced by elastomers during the process. The procedure mainly consists of the removal of the heart, intermediate storage facilities, dilation with water and the hydro-static pressure, colour injection of coronary vessels, fixation, dehydration in acetone, forced impregnation in a vacuum, and hardening **[6].**

BRAIN PLASTINATION:

It's a method of taking a human brain tissue, which is trained and combined with subsequent plastination of the sections. About one to four millimetre thick frozen sections have been stained with Astra blue or aldehydefuchsin that helps to provide a sharp contrast between white and grey matter **[7].**

There are also some specific techniques of brain plastination namely, P35 & P40 techniques, which ultimately includes the preparative stage of the head and embalming of the fluid consisting of 500 ml ethanol, 1000 ml formalin, 25 ml phenol liquefied, 300 gm of sodium chloride, 300 gm of chloral hydrate and 300 ml glycerine in 10 litres of water. The head is then rinsed in running tap water for two days after its removal from the body. The P35 technique was found to give excellent differentiation between grey and white matter of the brain **[8].**

Advantages:

1. They are non-hazardous, non-infectious, and do not radiate fumes or fluids.
2. Helps in the preparation of rare or historically imperative materials for museum display.
3. Helps in the preparation of surgically removed facial organs (nose and ear) for use as their own prosthetic replacement.
4. Helps in the preparation of tissue sample for use as evidence.
5. They can be stored in simple plastic bags, along with suitable credentials.
6. Helps in the conservation of organisms such as parasites, insects, snakes, or plants for instructional use.
7. Plastinated specimens require little storage and no maintenance. Thus, the time saved can be usefully redirected to increasing the collection rather than just maintaining it **[9].**

Disadvantages:

1. The procedure is technique sensitive, time consuming, and hence needs a devoted pathologist.
2. A beginner has to indulge in several trial and error moments during the procedure to attain the desired result which might lead to consumption/wastage of rare and unusual specimens.
3. Somewhat more expensive and needs more equipment's than the conventional laboratory methods.
4. The process needs lot of post curing works such as trimming, polishing, colouring, and mounting to obtain a good display of specimens.
5. Learning anatomy on only plastinated specimens is a compromise because of its restrictions in terms of tactile and emotional experience that is provided by wet cadavers.
6. Has a limited application in oral pathology, as the technique is more suitable for large specimens **[9].**

CONCLUSION:

Plastination as we now understand has made massive progresses and have been applied in various fields since its inception. It has been widely used in the field of teaching; it has been used to create samples for demonstration purposes. Apart from these, it has also been proven that, it's a strong preservation method when compared to several others such as formalin; it is hence, endorsed in oral pathology departments for conservation of museums, post graduate departments, etc.

Hence, plastination in recent times have begun to modernize the way in which anatomy is even perceived and projected to students and researchers worldwide **[10].**

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