The Application of an Indigenous Polymer for the Plastination of Teaching Anatomical and Biological Specimens

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Abstract

Plastination was fabricated in 1978 by Dr. Gunther Von Hagens at the University of Heidelberg,, Germany, which Kept for the good conservation of anatomical and biological material**.** The present goal was to utiliz a cost- effective plastination polymers as compared to the standard S10 technique using silicone polymers. The S10 is the original silicone polymer used for the preparation of plastinated specimens and whole dissecting body.

. Specimens were fixed in formalin 10%, dehydrated and decreasing in acetone, and at last,impregnated by local commercial unsaturated polyester resin and ultimately hardening at 50 °C temperature.

The plastinated specimens were clean, durable ,odorless ,portable and non-toxic ,it can be kept for long durations without any changes .The usage of widespread S10 silicon method is high costs so with the aid of using indigenous chemicals it is possible to produced low costs anatomical models for education and for studying anatomy**.**

Keywords: *polyester resin, education, impregnation, formalin, plastination.*

Introduction

In the plastination technique, the water and lipids in biological and anatomical tissues are substituted by a curable polymer. The hardener polymer give , dry, odorless, durable ,and devoid of noxious effects of formalin specimens. The first innovate of the plastination at the Anatomical Institute of Heidelberg university, Germany by Dr.Gunther Von Hagens in 1979 [(1)] **.**

In the last years plastination a large evolution take place in which gross anatomical and biological educations [(2)] .

The plastination laboratory was designed and established at the College of Veterinary Medicine, University of Basra since 2013 and has produced good quality plastinated specimens

Generally the polymers that used are the silicone, epoxy or polyester resins which hold the specimens in a dry, odorless state with minimal aftercare.

The main disadvantage of using formalin for fixation and preservation of tissues are that they are fritter when its handled , with difficultly transportation and troubles of spillage. In addition to its toxicity . However, formalin is still the main preservative of tissues due to its low costs, the plastination technique applied polymers which are forcefully impregnated into the tissues to get stable and free from deterioration specimens. They can easy handled and not brittle like the formalin preserved tissues [7]

The methods in plastination includes of four steps – fixation, dehydration, forced impregnation in a vacuum and hardening, many curable polymers used in this process [3].

An indigenous polyester resin was used in this procedure was cheaper ,with the same efficiency in comparison with standard silicon S10 , and it was a motivating materials when compared to other teaching aids like wet specimens, glass and wood models ., The plastination is being used as a method of preserving specimens and anatomical organs. at the College of

veterinary medicine, university of Basrah,

Materials and Methods

In the college of veterinary Medicine, University of Basrah, Indigenous polymer has been convenient for preservation of anatomical specimens and organs since 2013.

The procedure includes, Fixation, Dehydration, Forced impregnation, and hardening

Fixation

Anatomical specimens were fixed before plastination to avoid corruption and prevention the action of other enzymes. Whole fixation of the sample were very important to the final quality of a plastinated organ ,the plastinated specimens that have been fixed in 10 % formalin for several days according to its size , this gave the tissues steadiness and stops autolysis .The fixed organs were washed in clean water to rub from excessive fixative.

Dehydration

After formalin fixation the specimens were put in acetone for dehydration. There were three changes of acetone, each for three weeks, In this step, the acetone displaced gradually instead the water in the tissues. The volume of acetone should was 5-10 times than the volume of the specimens. Acetonometer (Fig1) was used every day to monitor the specific gravity of acetone and the level of dehydration. When the concentration stabilized at 98% the dehydration became complete.

Forced Impregnation

Acetone saturated specimens were transfer into a large vacuumed chamber

(Fig2) and submerged in locally obtained polyester resin(Fig.3) at freezer temperature 10-25 °C (Fig3) gradually the vacuum raised till reached 5 mm Hg using vacuum pump and vacuum gauge (Fig 4), Pressure can be controlled by adjustment of a shutoff valve in the line between the pump and chamber to stabilized the level pressure at the chamber. Impregnation checking by showing the acetone bubbles released from the polymer surface due to its lower boiling point +56°C, the indication to be complete when the acetone bubbles stopped liberation the specimens are taken out of the vacuum chamber. The excess resin is exsiccating.

Heat hardening

After complete impregnation the specimens cured in a heat treatment

at 50°C temperature for curing, final curing in an oven take about 7-10 days depending at the size of the specimens

Results

The plastination method can be used for whole body or organs, in human and animals, for Anatomical, pathological and surgical specimens in addition to biological samples such as parasites and insects (Fig:5). The advantage of this methods to obtained odorless dry and sturdy actual biological specimens (Fig:6) ,Non-toxic and can handles easy without gloves, preservation anatomical specimens without the usual problems such as moistened specimens, mould and not required special storage climate. By this method the students conceived to use of Plastination specimens in the dissection room to be helpful to anatomical education and it's a good and enjoyable method improved to understanding the anatomy for students and provides an additional tool for long –term maintenance for anatomical education

Fig.1: The specific gravity of acetone and the level of dehydration monitor by acetonemeter

Fig.2: a vaccum chambers for forced impregnations

Fig.3: polyester resin

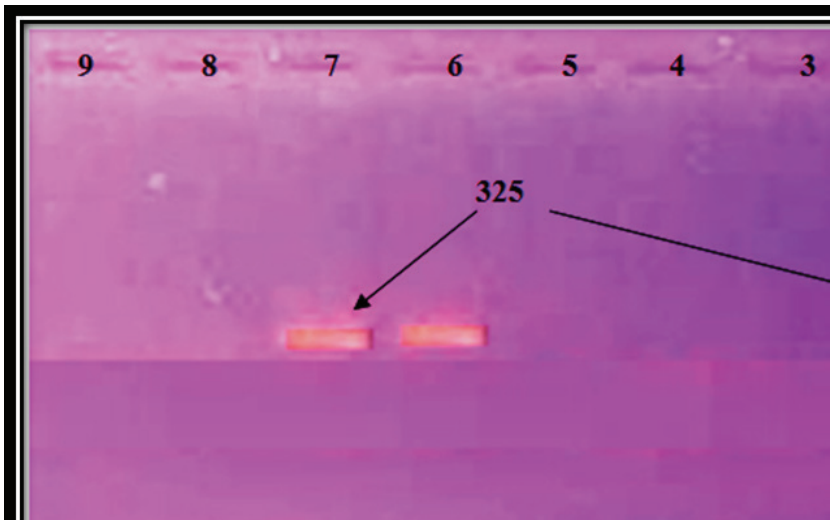

Fig.4: vaccum pump for dehydration and forced impregnation

Fig.5:plastinated biological specimences (insects)

Fig.6: plastinated heart of cow

Disscussion

The first foundation of plastination laboratory in Iraq and production of resin specimens at the college of veterinary medicine , University of Basrah, These characteristics are similar to [9] which mentioned that the plastination laboratory in the College of Veterinary Medicine at the University of Basra, Iraq, was designed and built to use the standard S10 method of plastination.

Plastination technique can be applied for whole body or organs, in human and animals, for anatomical,,pathological and surgical specimens in addition to biological samples such as parasites and insects, that in comparable with plastination has become an important means of preservation of organs, for well dissected specimens [8], The specimens obtained in our methods were dry, an odorless and non-toxic that can handled easy without gloves, its in agreement with [11] plastination technique has yielded dry, odourless and durable plastinates which are useful as an adjunct for demonstration at museums. Plastination was good and enjoyable method improved to understanding the anatomy for students and museums [6] explained that the specimens serves as a great aid for understanding anatomy of different organs

in their original form with any disturbance of smell.

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Conflict of Interest: None to declare.

Ethical Clearance: All experimental protocols were approved under the University of Basrah and all experiments were carried out in accordance with approved guidelines.

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