Original Article

Preservation of Specimens for Museum as A Recent Teaching Aid by Using Chloroform with Melamine at Room Temperature

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Abstract

Background: The preservation of cadavers is essential for delivering high-quality medical education and advancing scientific research. To create long-lasting, dry, and odorless teaching materials, plastination is an innovative preservation method that uses polymers to preserve entire bodies, body parts, anatomical specimens, and surgical samples in a lifelike state. **Material and Methods:** The present study aimed to develop a cost-effective plastination technique using an acid-curing polymer at room temperature, eliminating the need for expensive equipment such as deep freezers and vacuum chambers. **Results:** Formalin-embalmed cadaveric specimens, including the hand, knee joint and foot were prepared through routine anatomical dissection. The plastination procedure comprised fixation, dehydration, degreasing, polymer impregnation, and hardening. The primary chemicals used during the process were acetone, melamine and the acid-curing polymer chloroform. The developed technique successfully produced high-quality plastinated specimens while significantly reducing the overall cost of plastination. **Conclusion:** In the field of gross anatomy, plastinated specimens offer a valuable alternative to conventionally preserved specimens by improving teaching, demonstrations, and the understanding of anatomical structures and their spatial relationships. In conclusion the proposed room-temperature plastination method provides a practical, economical and efficient alternative to conventional formalin preservation. It eliminates the requirement for specialized equipment while maintaining specimen quality making plastination more accessible for anatomy departments with limited resources.

Keywords: Acetone, Plastination, Room-temperature, Melamine, Chloroform.

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INTRODUCTION

In learning anatomy,dissection of cadaver is the primary method of teaching.[1]Medical professionals across all levels agree that dissection is crucial for learning anatomy, as it provides relevant clinical correlations.[2,3] Anatomists have long sought a method that allows biological specimens to be preserved while maintaining their original characteristics and that may be kept outdoors without the negative consequences of formalin preservation.Cadaver preservation is crucial to medical education because it facilitates tissue transplantation and scientific study.[4] Most common preservative that used in most of medical colleges is formalin. This colorless and irritative fluid has 37% formaldehyde.[5]

During dissection hall demonstration to MBBS 1st year students the spillage & leakage of formalin is disturbing, non-aesthetic. There is difficulty in holding the formalin preserved specimen, some students complain of itching & burning sensation on their hands.

Dr. Gunther Von Hagens started experimenting with a novel method of specimen preservation.[6] Although plastics were described in a few articles before to his study, Dr. Gunther was the one who conducted extensive experiments on diffusing different polymers into big specimens, eventually succeeding and coining the word "plastination" in 1977.[7]

The Plastic coating method was simple and inexpensive, and the plastinated specimens were more flexible, durable, and lifelike than those preserved by the Plastic coating method. The use of plastination allowed the use of many body parts such as muscle, nerves, bones, ligaments, and central nervous system to be preserved.

Plastination is an interaction between anatomy and polymer chemistry, where a curable polymer is dragged or pushed into the specimen's cellular structure using a vacuum chamber. In order to stabilize and prevent tissue degradation, this process uses polymers that are forcibly impregnated into the tissues. Unlike the formalin-preserved tissues, they are not fragile and

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may be handled with ease. For the preservation of gross specimens, this approach has shown itself to be the best.
Plastination appears to have a bright future in training, research, public culture, and education globally. Numerous anatomical departments have access to it thanks to new, quick, and safe methods. For students, plastination offers a unique window into the realm of anatomy due to its lower prices and vibrant specimen look.[8]

Aim & Objective: To create an affordable plastination method employing an acid curing polymer (chloroform and melamine) at room temperature (without the necessity of a vacuum chamber or deep freezer).

Materials and Methods

The present study has been conducted in department of anatomy, G.M.C. Nagaur. For this study specimens are prepared by routine dissection from embalmed cadaver.
Specimens that are prepared from embalmed cadaver for plastination are following:

S.No.	Specimens	No of specimen
1	Hand	2
2	Knee joint	1
3	Foot	1
4	Heart showing chambers	1

Then we made plastinated models by following method –
Whole Organ Plastination - without using vaccum chamber & deep freezer (at room temperature)

Material needed

1. Formalin preserved specimens – Hand, Knee joint, Foot, Heart and section of upper half of body up to diaphragm
2. Glass jars
3. Acetone
4. Chloroform
5. Hardner
6. Paint brush
7. Dissection Kit
8. Mask
9. Gloves
10. Melamine

Figure1&2: Material required

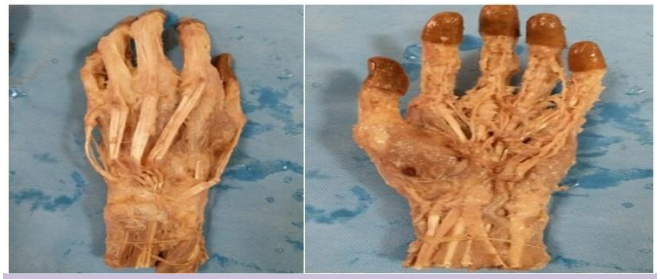

Figure 3&4: Dissection of specimen

Method: By using Chloroform + melamine
Plastination process by using Chloroform with melamine during impregnation step (Specimens for this method - knee joint, foot, hand, heart)
A: Fixation- To stabilize the tissue and stop autolysis, specimens should be preserved in 10% formalin for a few days. Since we get specimens from embalmed cadavers for our study, the specimens are fixed at that point. To get rid of extra fixative, the fixed specimens were rinsed in clean water.
B: Dehydration – Acetone was used to dehydrate formalin-fixed specimens [Figure 5]. Three acetone modifications were applied to the specimens. The tissue water is gradually replaced by the acetone over the course of three weeks (specimens were submerged in acetone for three changes every seven days). About ten times as much acetone was utilized for dehydration as there were specimens.
C: Degreasing: This process was done by using chloroform solution with 3 changes interval of 7 days. [Figure6]
D: Impregnation: This step was done in room temperature by using 1:1 ratio of chloroform and melamine for 10 days. [Figure7]
E: Hardening: After impregnation, transferred to the curing process by soaking in 9:1 ratio of chloroform &hardener in room temperature for hardening and drying. [Figure8]

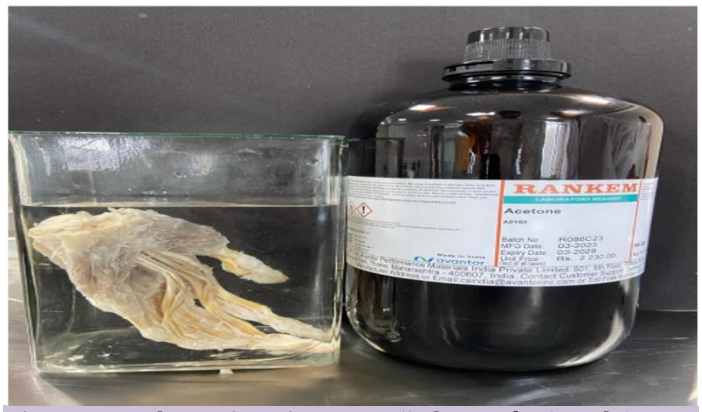

Figure 5: Put the specimen in acetone (3 changes for 3 weeks)

Figure 6: Put the specimen in chloroform

Figure -7: Put the specimen for impregnation(3changes for 3 weeks)

Figure 8: finishing of specimen & paint with melamine for hardening (mix of Chloroform + melamine along with hardner in equal ratio)

Results

Plastinated specimens prepared by using Chloroform with Melamine at room temperature

Plastination of hand (Figure – 9 & 10):

Figure 9: Palmar aspect

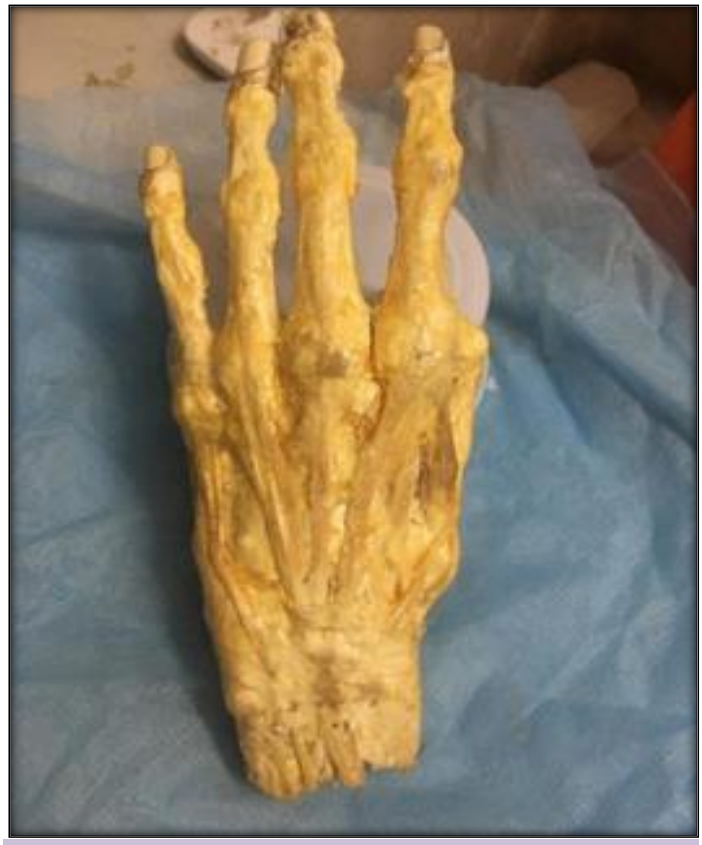

Figure 10: Dorsal aspect

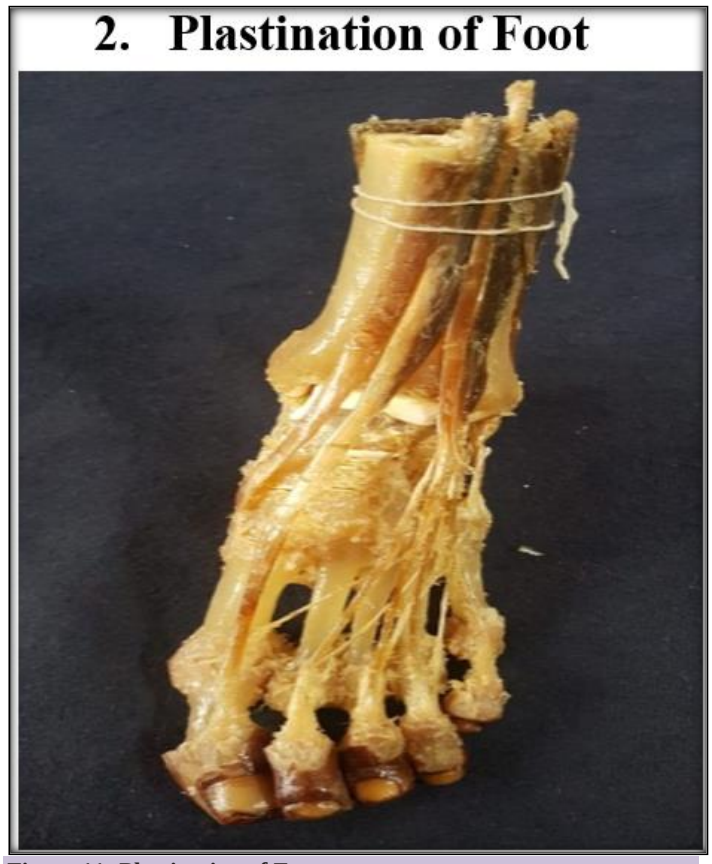

Figure 11: Plastination of Foot

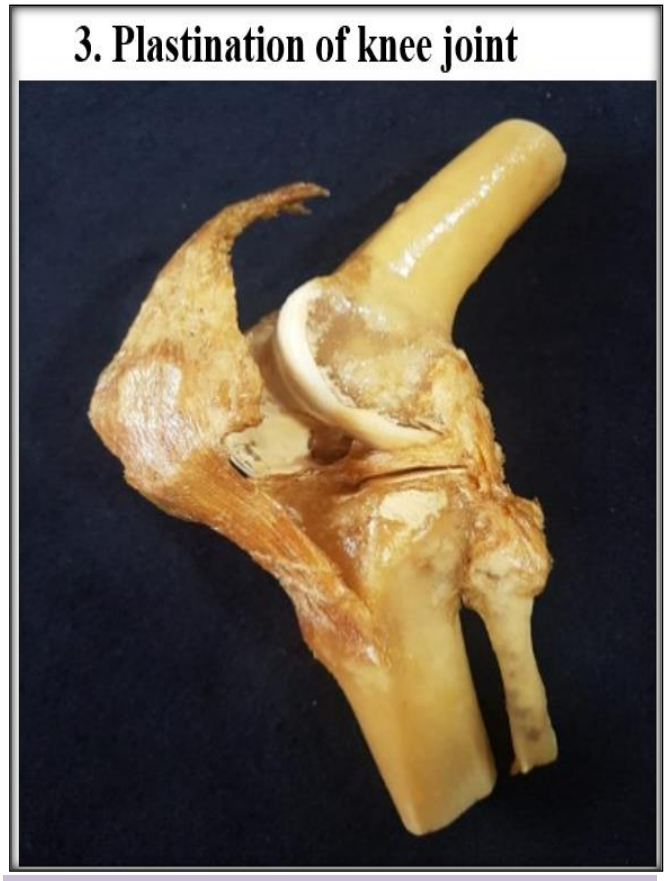

Figure 12: Lateral View of Knee Joint

3.Plastination of Heart

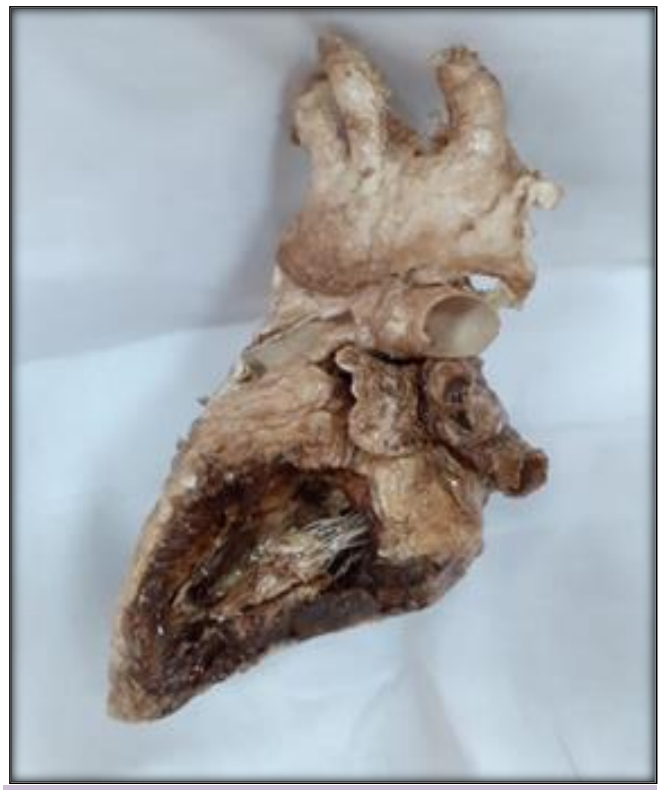

Figure 13: Plastinated Heart – A

Figure 14: Plastinated Heart - B

Discussion

The replacement of the leftover fluids in an embalmed body, for instance, with a polymer—a process known as plastination—was a superior advancement in the preservation of the body.[9]The plastinated specimens offer an ethically sound, durable and anatomically accurate representation of the human body, which can be handled and manipulated without the constraints of a cadaver, making them an available tool for hands on learning.[10-12]

Plastinations are dry, long-lasting, non-hazardous museum specimens that are great teaching tools for the anatomy and morphological traits of different specimens.[13] We try to preserve the specimens in our study using low-cost chemicals such as acetone, melamine, and chloroform.

A distinct advantage of plastination technique as it allows the display of specimens that are dry, odourless, non –toxic, easy to handle, can be easily stored not required any special jars for storage, easy to transport, more durable.

Our technique supports the use of this modified plastination method as a visible alternative for resource limited settings, paving the way for wider implementation in anatomical education. New trials for preservation of specimens have been a persistent aspiration for anatomists.[14]

In the field of gross anatomy plastination opened up new prospect. To enhance the knowledge and for better understanding gross anatomy and relationships of structure increasing the use of specimens during lectures and

demonstration.[15]

Conclusion

Plastination is both an art and a science since it calls for skill and the application of scientific knowledge. We may conclude that plastinated specimens are the best option for biological tissue preservation. Compared to formalin-preserved specimens, plastinated specimens are clean, dry, odorless, durable, non-toxic, non-infectious, do not emit fumes or fluid, are more aesthetically pleasing, may be handled without gloves, and don't need any specific storage conditions or maintenance. So plastinated models are used in anatomical museums and as teaching tools. However, plastination offers an extra tool for long-term preservation and serves as a teaching tool for human anatomy, even though it cannot replace traditional dissections.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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