JAMC Vol. 13 No.1, 2001

PLASTINATION OF WHOLE BRAIN SPECIMEN AND BRAIN SLICES

ARBAB ABDUL WADOOD, ABDUL JABBAR AND NIRMAL DAS*

Department of Anatomy and * Pharmacology! Bolan Medical College, Quetta.

Background*:* The human dead body specimens are plastinated for teaching purposes in medical institutions, using silicone. The silicone impregnated whole brain specimens and brain slices do not give satisfactory results. *Methods:* In the present study the brain specimens were plastinated with another polymer known as Polyester-Copolymer. The brain specimens were first preserved and then fixed with 5% formalin. The specimens were then dehydrated and degreased in a volatile solvent acetone. The specimens were placed in Polyester- Copolymer solution which penetrated the brain tissue both intracellulary and intercelluraly. The specimens were then cured by gas method. ***Results:*** The whole brain specimens and brain slices plastinated with Polyester-Copolymer were dry, odorless, handy and durable. It also gives a clear visual contrast between grey and white matter in brain slices whereas the brain specimens plastinated with silicone are flexible and sticky. There was no color contrast between grey and white matter. ***Conclusion:*** The polyester impregnated brain specimens and slices are non-toxic and ideal for teaching purposes and examinations. They require minimal aftercare. The whole organ serial sections of plastinated brain specimens will help 3- dimensional study of the normal brain and will improve the assessment of brain pathology.

INTRODUCTION

Plastination is a unique and latest method of preserving tissue in a lifelike state. Plastinated specimens are dry, odorless, durable and non-toxic. The specimens that are plastinated, maintain their original shape, and in many cases are close in color and consistency

In plastination process, water and lipids in tissues are replaced by a polymer (rubber or plastic) that is subsequently cured'. By this method dissected human dead body, viscera, body slices and organ slices can be plastinated.

The basic principal of plastination includes fixation, dehydration, forced impregnation and curing (Hardening). The specimens are first fixed by 10% formalin. After that the specimens are dehydrated and defatted by soaking the specimens in a volatile solvent. Forced impregnation is done by placing the specimens in a polymer solution. When vacuum is applied, the volatile solvent is extracted in its gaseous state from the specimen. The evaporating volatile solvent creates a vacuum deficit within the specimen drawing the polymer into the tissues as its replacement[4].

The polymers used for plastination are usually silicone, polymerizing emulsion and epoxy resin. The brain specimens plastinated with these polymers do not gives satisfactory results[5] as it does not give clear contrast between grey and white matter of brain slices while obtained specimens are easily breakable and hardening is not complete.

The present study was designed to use another polymer, polyester copolymer for whole brain specimens and brain slices and to assess the standard of polyester-copolymer plastinated brain specimens and slices as compared to that of silicone plastinated brain specimens and slices.

MATERIALS AND METHODS

Forty fresh brain specimens were obtained from formalin preserved cadavers. The experiment was conducted in the plastination laboratory of Anatomy department. Bolan Medical College Quetta. Out of forty, twenty brain specimens were sliced and twenty were unsliced. The brain slices were made 7mm thick by meat sheer as the suitable thickness of brain specimens for plastination is reported to be 4 to 8 **mm[6].**

Whole brain specimens and brain slices were fixed in 5% formalin for 2 weeks. Since water and lipids are not exchanged directly with polymer, so the specimens were dehydrated and degreased by acetone. For dehydration specimen were placed in 90% cold acetone (-25° C) for 12 days in a stainless steel basket. The basket was placed in a freezer. The dehydration of specimens for plastination by cold acetone at -25°C is best method as it causes minor tissue shrinkage when compared to ethanol dehydration[7]. For degreasing, the specimens were then placed in acetone at room temperature for 48 hours.

The brain specimens were now divided into 2 groups Control Group: 10 whole brain specimens and 10 brain slices for silicone impregnation.

Experimental Group: 10 whole brain specimen and 10 brain slices for polyester-copolymer impregnation.

The whole brain specimens and slices from

control group, soaked in volatile solvent, were placed in a plastination kettle (Biodur, Germany) containing silicone solution. While the whole brain specimens and brain slices from the experimental group, soaked in volatile solvent, were placed in another plastination kettle containing polyester- copolymer solution. Vacuum was applied using a vacuum pump connected to each plastination kettle. Vacuum pressure was adjusted by manometers.

Volatile solvent was extracted from brain tissue in gaseous state and the space created in the brain tissue was filled with silicone in case of control group and with polyester-copolymer in case of experimental group. This procedure was carried out in cold (-25° C) for about 72 hours in plastination kettles.

After forced impregnation of the brain specimens and slices, they were then hardened (cured) for six hours using gas method. The impregnated specimens and slices were placed in airtight wooden chamber containing Gas Cure-S6 (Biodur Germany, patent). The chamber was equipped with a fan for even distribution of gas in the curing chamber.

In this way the impregnated specimens and slices were brought into contact with a gas, which hardens the impregnated brain specimens and slices

RESULTS

After fixation, dehydration, degreasing, polymer impregnation and curing, the whole brain specimens and slices were examined and a comparative study was done between silicone impregnated and polyester-copolymer impregnated brain specimen and slices.

The following results were observed: - 1. The whole brain silicone impregnated specimens were easily breakable, hardening was not complete and the specimens were sticky. The brain slices did not show clear contrast between grey and white matters. (Figure-1).

Figure: 1

2. The whole brain polyester-copolymer specimens were odorless, hard, dry, hand able and could not be broken easily (Fig-2). The brain slices showed a clear contrast between grey and white matters. (Fig-3)

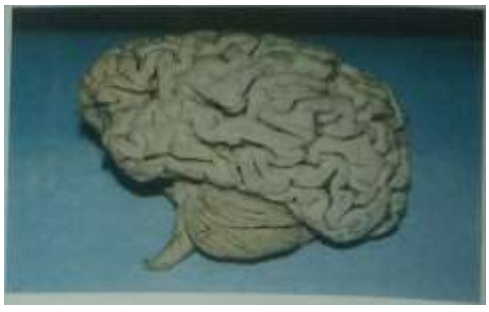

Figure-2

Figure – 3

DISCUSSION

Decay is a vital process in nature but an impediment to morphological studies, teaching and research. Therefore, it has always been a goal to find suitable preservation technique, especially for anatomists and pathologists. Thus a new method of preserving specimens by Hagens in 1977 was invented and named as plastination[8].

The technique of plastination is an established and gentle method for tissue preservation[9]. Plastinated specimens can be retained on permanent bases to be used over and over, with nearly the same impact as the original autopsy | Plastination of bones and teeth has proven valuable for teaching in odontology and anthropology.

The old traditional method of organ and tissue preservation and storing is by using formaldehyde or alcohol[12]. Formalin fixed and preserved specimens and organs cause wetting of hands, textbooks and cloths of students. The carcinogenic potential of formalin is under debate. Formalin is odoress and causes formalin tears.

Plastination is a latest method of preserving tissues. Plastinated specimens are dry, odorless, durable and non-toxic. They even retain their surface relief and cellular identity down to the microscopic level[16].
Basically three varieties of plastination technique are used. Each technique depends upon the type of polymer (Plastic or rubber) used. These are silicone, polymerizing emulsion and epoxy resin. All types of specimens, impregnated with afore mentioned polymers, give good result except for brain specimen[17]. The present study was conducted to

plastinate the whole brain specimens and slices with a polymer other than above three.
The following differences were noted between whole brain specimens and slices
impregnated with silicone (control group) and polyester-copolymer (test group):

a. The brain specimens plastinated with polyester- copolymer were odorless, dry hand-able, hard, non- breakable, non-sticky and durable. The brain slices exhibited a clear distinction between grey and white matter.
b. The brain specimens plastinated with silicone were breakable, soft and sticky to touch. The brain slices failed to reveal a clear contrast between grey and white matter.

Thus teaching by polyester-copolymer impregnated whole brain specimens and brain slices greatly benefits due to its durability, easy handling and excellent distinction between grey and white matter. They will be much preferred by both students and teachers owing to their accessibility, superior illustrative powers and comparative ease of interpretation.

Serial slices of polyester plastinated brain specimens will allow the three dimensional, computerized reconstruction of complex brain structure. The depiction of human brain viewed in slices facilitates the interpretation of radiographic, ultrasonographic and computed tomographic images.

Thus the pathological brain specimens can be plastinated by using Polyester-Copolymer for teaching, diagnosing and research purposes as they are clear odorless and require minimal aftercare.

The plastinated brain specimens also offers a means of keeping specimens without the usual problems associated with wet specimens such as desiccation, mould and specific storage requirements.

REFERENCES

1. Hagens G. Plastination technique. Heidel. Plast. Folder. l986; l-7.
2. Brickley H C. Walker A N and Jackson R L and Donnars R S. The preservation of pathology specimens by silicone plastination An innovative adjunct to pathology education. Am.J. Clin Pathol. 1987;88(2):220-23.
3. Hagens G. Impregnation of soft biological specimens with thermosetting resins and elastomers. Anat. Rec. 1979; 194; 247-255
4. Klanes T and Wilhelm K. The current potential of plastination Anat. Embr. 1987; 175:411-21.
5. Hagens G, Kriz. Plast. Folder. 1985;5-17.
6. Hagens and Tiedemann Plastination. Anat. Embr. 1984;210-211.
7. Schwab K H and Hagens G. Freeze substitution of macroscopic specimens for plastination. Abstract. Sixth European Anatomical Congress. Acta. Anat. 1981, 111(12) 399
8. Kieneke E W. Uhlmann K. Easy method of producing biological specimens by molecular substitution. XII. Int Anat Congr London. Abstr. 1985; 354.
9. Sittel C. Eckel H E and Sprinzl G M. Section plastination of larynx for histology of whole organ sections. HNO. 1996; 44(7)370-5
10. Stoka K and Schit G. Utilization of the postmortem examination with emphasis on audiovisual aids. Arch Pathol. Lab Med. 1987;11 U9):883-84.
11. Hawley DA. Marlin DC, Cook DC, Becsay D, Clark M A, Pless J I; and Stanish S M. Specimens for teaching forensic pathology, odontology and anthropology. Am.J. Forensic-Med. Pathol 1991; 12(2): 170-174.
12. Deegner P and Berndta W. Process of preserving animal object. U.S. Pat.l914; l, 163,645.
13. Acheson E D Formaldehyde in British chemical industry. Lancet. 1981; 1:611-616.
14. Daschner F. Formaldehyde. Klinikartz. 1983; 12(1): 9-10.
15. Pabst R Wetche Gefahren bestehen beim umgang mit. Formaldehyde. Anat, Anz. 1985; 161:154.
16. Bickley H C. Plastination, a new technique for anatomic pathology and forensic science. Pathol. Update Series. 1984;2(16);2-8.
17. Bickly H C, Hagens G and Townsend F M. An improved method for preservation of teaching specimens. Arch. Pathol. Lab. Med. 1981;105: 674-676.