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Correlating sheet plastinated slices with magnetic resonance images of brain in Jodhpur

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Abstract
Introduction: Plastination is the method of long term preservation of the biological tissues with completely visible surface and high durability. In this technique, the water and fat of the body are replaced by certain polymers. The specimens obtained after plastination are called as Plastinates. It was developed by Dr. Gunther von Hagens in 1978 at the Heidelberg University in Germany. Sheet plastination involve the making of thin transparent of thick opaque section body or an organ.
Material and Method: The study was conducted at Dr S N Medical College Jodhpur Rajasthan. Human cadaver fixed in 10 % formalin was used in this study. Cadaveric brain is used and 2- 5 mm slices are prepared with sharp knife indifferent levels.
Result: sheet plastinated finished specimen are durable, easily labelled, make superb backlight museum exhibit for teaching and also offer enormous research possibilities.
Conclusion: the combination of plastination and radiological technique as describes in this study will allow students, radiologist and anatomist to gain better insight into the three dimensional relation of anatozmical structures in brain and certain region also.

Keywords: MRI, sheet plastination of brain, teaching

1. Introduction
Plastination is the method of long term preservation of the biological tissues with completely visible surface and high durability. In this technique, the water and fat of the body are replaced by certain polymers. The specimens obtained after plastination are called as Plastinates. It was developed by Dr. Gunther von Hagens in 1978 at the Heidelberg University in Germany. Sheet plastination involve the making of thin transparent of thick opaque section body or an organ [1].
Sheet plastination used to produce anatomical slices of different body structures, allowing one to study and teach their topography in an anatomical correct state. Correlation with MRI technique gives more insight into their anatomy [2].
The direct comparison between E12 serial sectioned cadaver specimen of brain and the equivalent MRI images provides the students with a much clearer understanding of anatomical structures in the relation to clinical diagnosis [3].

2. Material and Method
The study was conducted at Dr S N Medical College Jodhpur Rajasthan.

3. Material needed for sheet plastination
A) For Sheet plastination
1. Epoxy resin and Hardner
2. Dissection instruments;
3. Syringes, needles
4. OHP sheets
5. Glass jar
6. Glass rod
7. Measuring cylinder
8. Acetone
9. 2 Plastic box

B) For Formalin

1. Dissected organ
2. 10 % Formalin
3. Glycerin

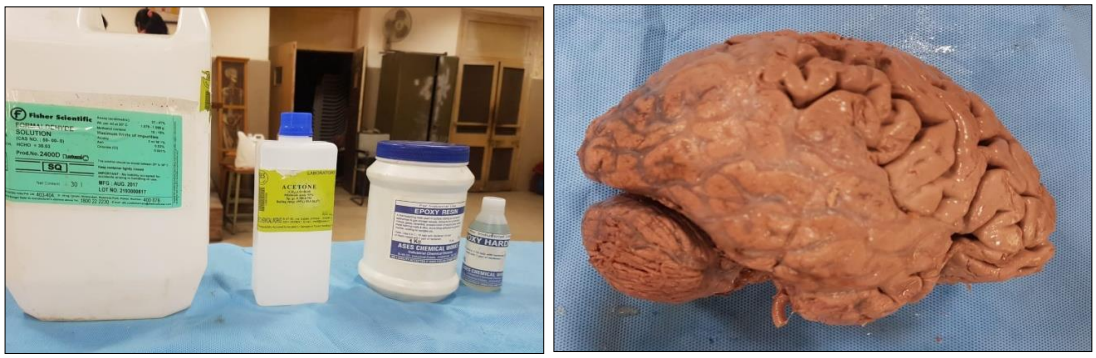


Fig 1: Material used for sheet plastination and cadaveric brain specimen

This is a wonderful method of preparation of thin-transparent or thick-opaque body sections. The sheets are totally portable, the whole body being convertible into slices & stored dry.

- Formalin preserved Brian was taken from the department.
- 2-6 mm slices of brain cut with knife in different plane like coronal, transverse and mid sagittal.
- Then Put these slices in acetone for 3 weeks, specimens were passed through 3 changes of acetone for removing fat and formalin fumes.

(Specimens were immersed in acetone for 3 changes each of 7 days)

- Wash in water
- Blotted in blotting paper to remove excessive water
- For impregnation process (without vaccume chamber) put these slices in solution of epoxy without mixing hardener for 10-15 days.

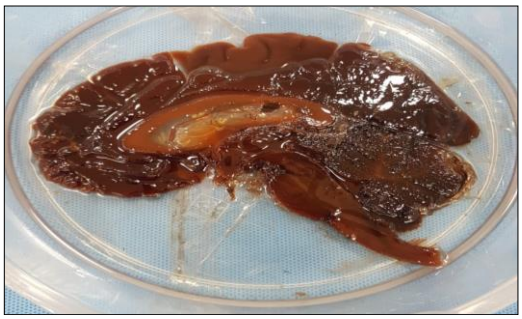


Fig 2: Brain slices placed in epoxy resin for plastination

The section has to be cast in the form of a sheet

- An OHP Transparent sheet is requiring.
- Then we made OHP sheet box according to size of specimen with at least 4-5 mm clearance from the margins.
- OHP sheet box completely shield with cello tape
- Pour the epoxy resin in glass jar with hardener in 10:1 with help of measuring cylinder.
- Slowly mix with glass rod
- Now in the OHP sheet box pour the resin.
- This is to be kept for few minutes to remove the bubbles.
- Now place the specimen on this layer.
- Again mix the epoxy resin with hardener in the same ratio, top the specimen with another layer
- Allow it to set.

Care would have been taken

- The transparency sheets are carefully peeled off from one edge.
- Care would taken if there is any doubt that it is still not totally solidified, another day of patient waiting is preferred, than losing a precious specimen; drying in heat, sunlight is not recommended.
- Edges can be finished using a grinding machine; labelled & stored in plastic covers or dust proof boxes.

4. Observation And Result

The finished specimens are durable, easily labelled, make superb backlight museum exhibit for teaching and also offer enormous research possibilities. As a result of the lipid extraction, the muscle and vasculature are significantly highlighted against the cleared fat, with joint structures particularly well presented. In this project to test undergraduate anatomy students with corresponding plastinated slices and MRIs in order to statistically determine the educational value if the two distinct anatomical media.

Symmetry of Intracranial contents

1. Normal grey-white differentiation,
2. Deep nuclei
3. Brainstem & cerebellum
4. Sinus and blood vessels

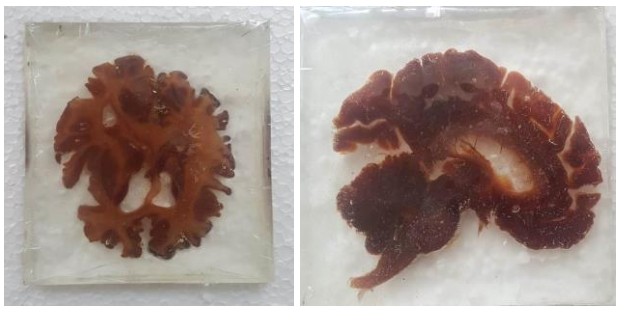
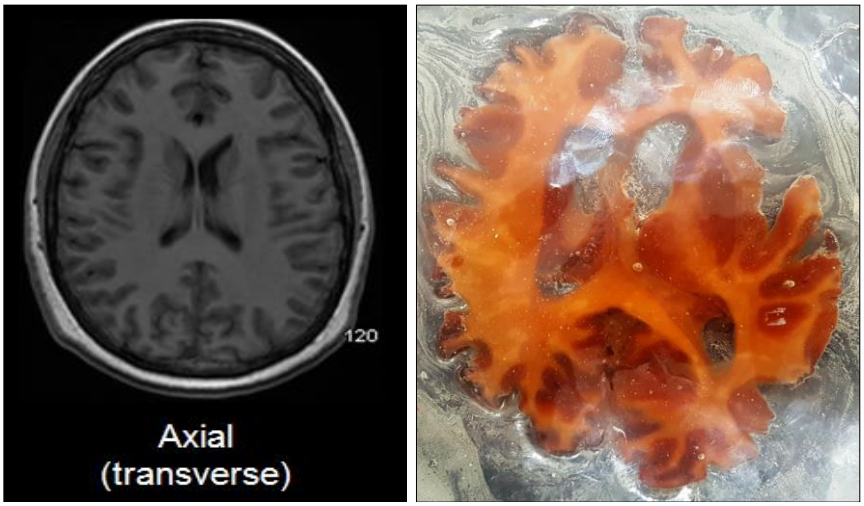


Fig 3: Sheet plastinated of brain transverse section and sagittal section

There are three primary imaging planes that are utilized in MRI

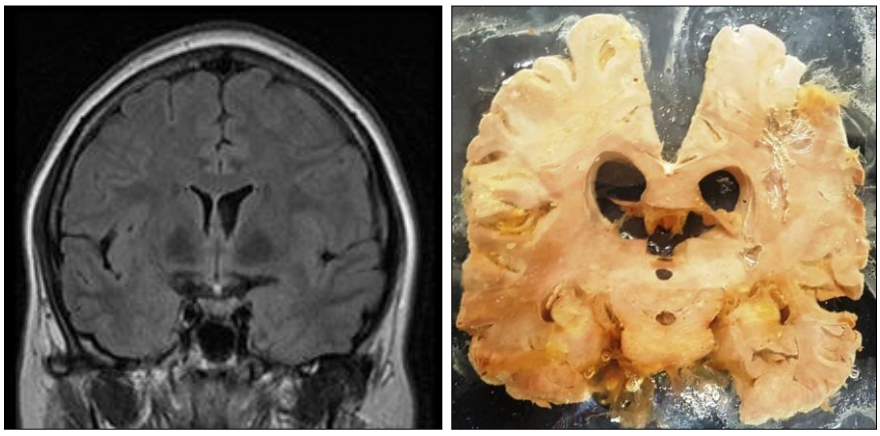
- **Axial plane**: Transverse images represent "slices" of the body

- **Sagittal plane**: Images taken perpendicular to the axial plane which separate the left and right sides (lateral view)
- **Coronal plane**: Images taken perpendicular to the sagittal plane which separate the front from the back. (Frontal view)
- We can correlate the normal anatomical landmarks by seeing the brain plastianted slices and magnetic resonance imaging (MRI).Certain structures are seen in MRI and plastinated specimen.
  - White matter
  - Gray matter
  - Fissures
  - Lobes
  - Ventricles
  - Sulci
  - Gyri
  - Vasculature
  - Basal nuclei



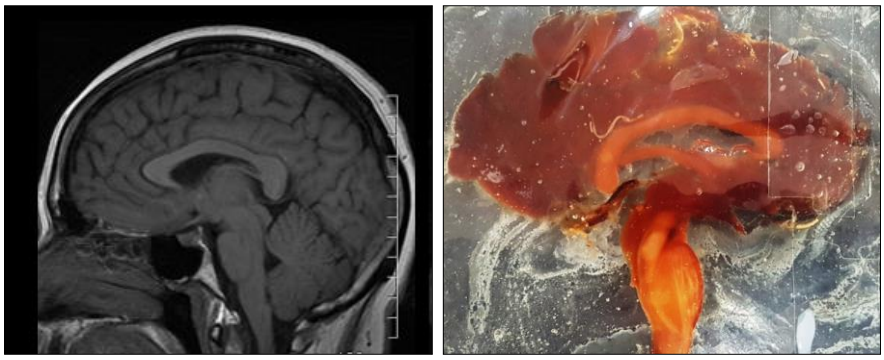
MRI Brain Slice Plastination

Fig 4: Transverse section



MRI Brain Plastinated Slice

Fig 4: Coronal section



MRI Brain Plastianted Slice

Fig 4: Sagittal section

5. Discussion

In present study we used an alternative approach called "plastination" to study and teach gross specimens using silicone polymers. The process is simple, inexpensive, and can be carried out in any laboratory to produce dry, odourless, durable, life-like, maintenance-free, and nonhazardous specimens. In this study we use formalin preserved specimen for plastination [4].

Plastinated specimen provides good visual appearance with clear surface detail. They exhibit an excellent contrast between adipose tissue which appears white and all other parenchyma [7].

Cadaveric specimen provides a standard and a means of demonstrating the limitation of imaging modalities. It has been noted that vasculature was poorly illustrated in these images because cadaveric tissue was used. In living subjects blood vessels are more readily seen. The plastinated section provides confirmation that the slices obtained by MRI are a true representation of that area of the body. Potentially drawback of plastination is the possibility of shrinkage of the brain during processing. This consolidates the fact that plastination preserve the neural relation and characteristics of anatomical structures.

Sheet plastination is currently used in teaching and research to produce anatomical slices of many different body structures or anatomical regions. These kind of anatomical specimens allows one to study in detail and to teach with high precision either easy or complex anatomical structures. Thin anatomical slices combined with the use of polymers as polyester resin P40 (BIODURTM) achieve an anatomical accuracy close to detail that provides a histological study [8].

We also demonstrate the usefulness of thin plastinated slices in learning 3D topographical relationships of anatomical structures that exhibit a complex anatomic path.

In our study first we compare plastianted model with standard MRI sheets. We observe gray matter, white matter easily distinguishable and under stable by students in sheet plastiamted model. It help to them understand the MRI sheet more clearly through these plastianted model. Nuclei are also well marked and ventricle seen more clearly in plastinated model.

The plastianted section provides confirmation that the slice obtained by MRI is a true representation of that area of the body.

A number of studies have compared plastinated specimen prepared by alternative technique to radiographic material. Example includes; S – 10 plastianted section of a surgically removed invasive apocrine carcinoma of the peripheral glands were compared to CT images made prior to surgery to verify and support the accuracy of the clinical diagnostic images.

6. Conclusion

The combination of plastination and radiological technique as describes in this study will allow students, radiologist and anatomist to gain better insight into the three dimensional relation of anatomical structures if brain and certain region also.

Plastinated specimens are an excellent alternative to formalin-fixed specimens. The plastinated internal organs are dry odorless, easy to demonstrate the gross morphological details over the formalin in which high concentrations of formalin can not only discolour the specimens, but it also makes them toxic, hazardous, fragile and unpleasant to use. The principle behind plastination is that the water and fat of the tissues are replaced by certain plastics, yielding specimens that not only retain most properties of the original sample but also do not smell or decay.

Plastination has a great future in all fields of teaching and research. Natural appearance of the specimens makes the plastination a boon for anatomy learners. It is a good replacement for formalin as a preservative and there are no health hazards. Plastination has a great future in all fields of teaching and research. Natural appearance of the specimens makes the plastination a boon for anatomy learners. It is a good replacement for formalin as a preservative and there are no health hazards.

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