Journal of the Anatomical Society of India 67 (2018) 77–79

Contents lists available at ScienceDirect

Journal of the Anatomical Society of India

journal homepage: www.elsevier.com/locate/jasi

Original Article

Deplastination: Making plastinates histo-pathologically relevant

Deepak Vinod Francis*, Suganthy Rabi

Christian Medical College, Vellore, TN, India

ARTICLE INFO

Article history:
Received 13 June 2017
Accepted 12 December 2017
Available online 13 December 2017

Keywords:
Plastination
Sodium methoxide
Endpoint
Haematoxylin and eosin staining

ABSTRACT

Introduction: Deplastination is a process that reverses plastination. While the process is in its infancy, this study was designed to see if deplastinated tissues can be used for histopathological studies.
Methods: In this study, a slice of liver tissue was split into two parts. The first half was processed, sectioned and stained with routine H&E staining while the other half was plastinated with S10 plastination technique and was deplastinated after 3 months using sodium methoxide as the deplastinating agent. It was latter stained with routine H&E. The slides were assessed qualitatively on parameters like tissue and cell identification, staining property, preservation of tissue architecture, visualisation of intracellular structures like nuclei, nucleoli, fat goblets etc. and presence of artefacts due to the process.
Results: Identification of tissue was possible on the deplastinated slides. Intracellular structures like nuclei, nucleoli, fat droplets were identified in the deplastinated slides.
Discussion: In this study, we have found that sodium methoxide and methanol form good deplastinating agents for small sections of tissue. Identification of endpoint of deplastination forms a crucial step in the process.

1. Introduction

Plastination is a process where an organic tissue is converted into a plastic model or 'plastinate' by replacing water in the tissue with a polymer (mostly silicone). The process while time consuming is beneficial since the plastinates theoretically last forever. They preserve the anatomical structure and are useful in outside the Dissection Hall teaching for non-dissection based courses and exhibitions. They also help to preserve rare specimens without any need for preservatives long term which have their own harmful environmental effects on disposal.

While plastination has its benefits, there are a few drawbacks. The plastinates do not allow further dissection. It also prevents further research on the plastinates specially in case of rare specimens. Safe disposal of plastinates is also an issue since they do not decay with time. Routine histopathological studies cannot be done with the plastinates as sectioning will be difficult. Deplastination is a process that reverses plastination. This present study aims to find out whether deplastinated specimens can be used for histological purposes.

2. Materials & Methods

The study was done in the Department of Anatomy, Christian Medical College, Vellore. A slice of liver tissue was extracted from a cadaver donated for educational and research purposes to the Department of Anatomy. Half the tissue was processed for routine histology and stained with haematoxylin and eosin. The other half of the tissue was plastinated with S10 Silicon plastination technique as described by von Hagens.[1] After a period of 3 months post plastination, the tissue was subjected to the process of deplastination. Deplastination was carried out by immersion in a 5% solution of Sodium Methoxide in 90% methanol as described by Grondin et al.[2] Endpoint of deplastination was identified by the ease of a needle passing through the tissue. The tissue was then processed for paraffin sectioning as shown (Fig. 1) and the slides were stained with routine haematoxylin and eosin. The slides were then assessed by the investigators on parameters like tissue and cell identification, staining property, preservation of tissue

* Corresponding author at: Department of Anatomy, Christian Medical College, Bagayam, Vellore, 632002, TN, India.
E-mail address: deepufranc98@gmail.com (D.V. Francis).

https://doi.org/10.1016/j.jasi.2017.12.007
0003-2778/

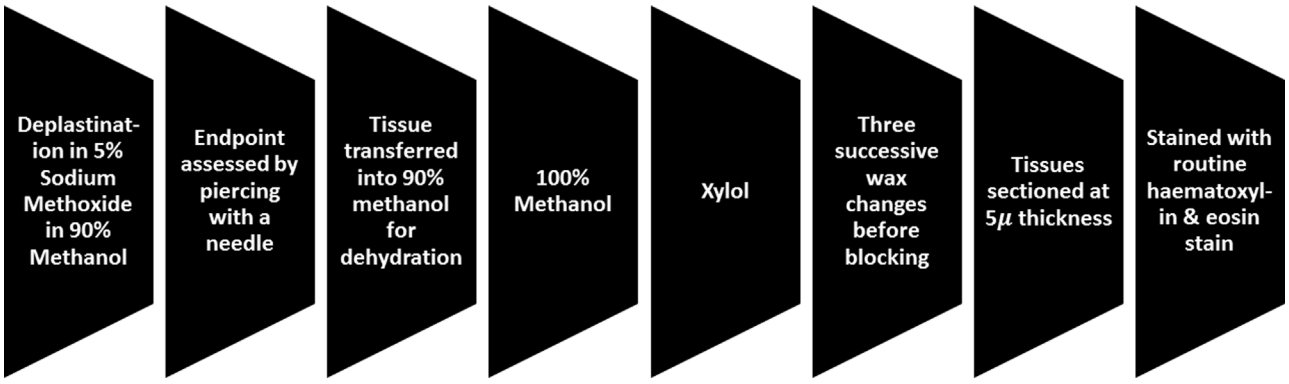

Fig. 1. The steps followed from deplastination to staining.

architecture, visualisation of intracellular structures like nuclei, nucleoli, fat goblets etc. and presence of artefacts due to the process.

3. Result

The deplastinated sections yielded themselves to staining with routine haematoxylin & eosin. Identification of tissue was easily possible on the deplastinated slides. When assessed for Staining property, staining was good in both the formalin fixed and deplastinated slides with slightly longer time needed to stain the deplastination slides. The architecture of the deplastinated tissue was maintained and were comparable. Intracellular structures like nuclei, nucleoli, fat droplets were clearly seen in both the slides. Differentiation of the different cell and tissue types was again easily possible in both the groups (Fig. 2.)

4. Discussion

Plastination is turning out to be an important tool in the armamentarium of an anatomist in the current age. Its use as an adjunct in dissection based teaching schedule as well as a primary teaching aid in a non-dissection based teaching has been well established.[3]

While Plastinates have their benefits, they also have their drawbacks. Most of the drawbacks can be minimised by careful planning and by modifying the process. Since the specimens are converted to plastic models, dissection is not possible once plastinated. Utmost care must be taken to dissect and show the relevant area before plastination is started. The relevant areas can also be highlighted by a process called colour plastination.[4,5] The weight of the plastinates which can be heavy and cumbersome for transport can be drastically reduced by light weight plastination.[6]

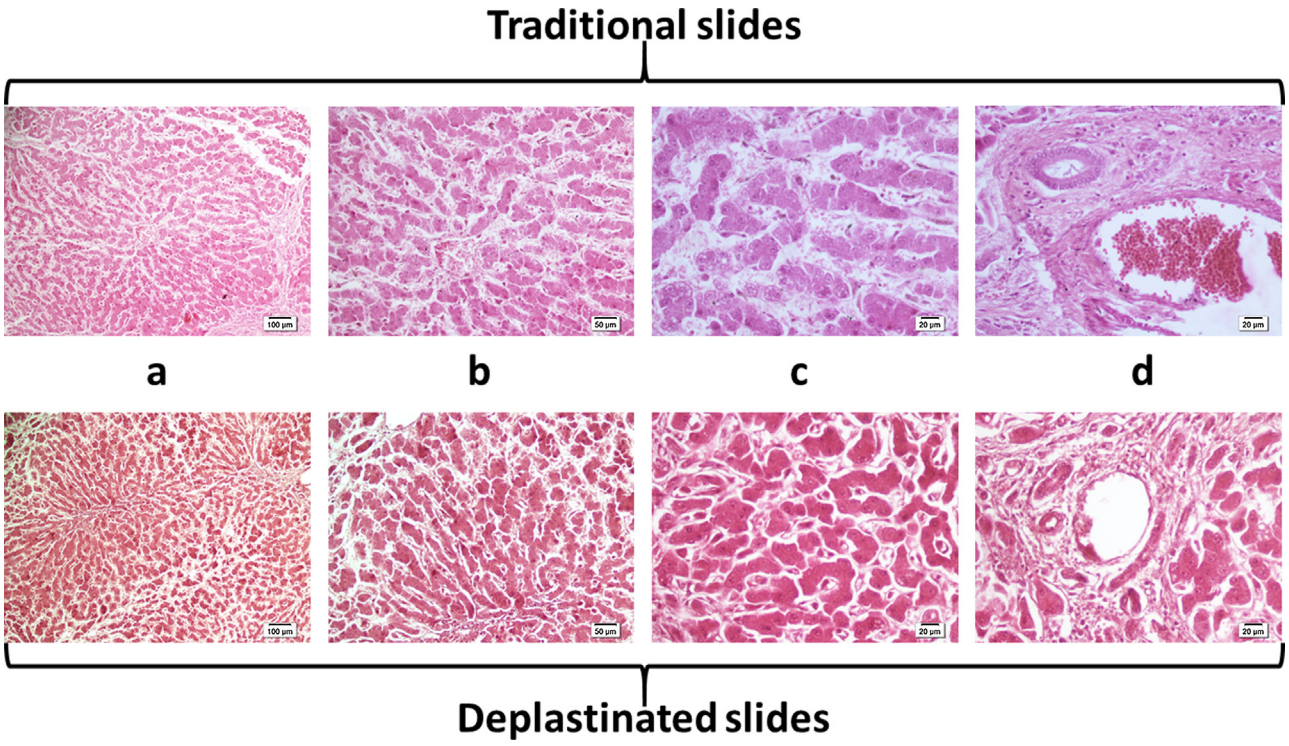

Fig. 2. Photomicrographs of the slides comparing formalin fixed tissues and deplastinated tissues at various magnifications. a) 10× objective, 2) 20× objective, c) 40× objective, d) 40× objective showing the portal triad.

One of the major drawbacks of plastinates is that unlike a formalin fixed tissue, it cannot be used for further histopathological studies. Since the process yields theoretically a structure which doesn't decompose, its disposal and stress on the environment need to be considered on a long-term basis. While the latter issue is yet to be resolved, steps have been taken to solve the former difficulty by the process of deplastination. Deplastination is thought to occur when the crosslinking of the silicon polymers is broken down by Na ions.[6,7] Ripani et al. tried different deplastination agents like alcohol, methylbenzene, methylene and Bichloride acetone and concluded that while deplastination was possible, it did not yield good slides.[7] On the other hand, Grondin et al used sodium methoxide and found that it yielded good histopathological slides though the endpoint of deplastination is not mentioned nor is the staining process post deplastination.[2] While these latter articles do mention that deplastination is possible, they use an arbitrary time limit of 48 h. In this study, sodium methoxide was found to be the better deplastinating agent for the reasons of assessing endpoint of deplastination and the convenience of time. The other agents tend to consume more time for deplastination. It was observed that the time taken for deplastination varied based on size of tissue, storage of sodium methoxide etc. If deplastination was incomplete, the slides tend to show various artefacts and were not usable for histopathological studies as documented by Ripani et al.[7] If excess time was given, the tissue tended to become brittle and powdered off during microtomy.

Assessing the softness of the deplastinating tissue by poking using a needle was found to be a good way of assessing the endpoint. This process becomes important since deplastination seems to occur from the surface and the softness of the surface doesn't correlate with that of the deeper tissues. This also limits the thickness of the tissues to be deplastinated to get optimal results on both the surface and deeper tissue. We used slices of 3–5 mm thickness for the study.

Methanol and isopropyl alcohol were tried separately for preparing the dehydrating agent. Isopropyl alcohol was not found to be ideal and formed a poor substitute for methanol. Trials were made dehydrating the tissue with 70%, 90% and 100% methanol and better slides were obtained when the process was started at 90% methanol.

5. Conclusion

In conclusion, deplastination using sodium methoxide and methanol is a good technique for retrieving histopathological data from plastinated tissues and correct assessment of the endpoint of deplastination is essential to obtain a slide comparable to traditionally prepared sections.

While deplastination is possible on a small tissue, an alternative for sodium methoxide needs to be identified when deplastinating large specimens for histopathological studies and/or disposal.

Conflict of interest

None

Funding

No funds were used for this study

Acknowledgments

I would like to thank God Almighty and CMC, Vellore for the opportunity given in addition to Mr. Balakrishnan and Mr. K.R. Gopi for their help in the process of plastination and Mrs. Amsaveni and Akila Williams for help during the staining process.

References

1. Hagens G von. *Heidelberg Plastination Folder: Collection of Technical Leaflets of Plastination*. 2nd ed. .
2. Grondin G, Grondin GG, Talbot BG. A study of criteria permitting the use of plastinated specimens for light and electron microscopy. *Biotech Histochem Off Publ Biol Stain Comm*. 1994;69(July (4)):219–234.
3. Suganthy J, Francis Deepak Vinod. Plastination using standard S10 technique – our experiences in Christian Medical College, Vellore. *J Anat Soc India*. 2012;61 (June (1)):44–47.
4. Shanthi P, Francis DV, Suganthy J. Colour plastination—a valuable tool for medical education. *J Anat Soc India*. 2015;64(December (2)):152–154.
5. Steinke H, Spanel-Borowski K. Coloured plastinates. *Ann Anat Anat Anz Off Organ Anat Ges*. 2006;188(March (2)):177–182.
6. Steinke Hanno, Rabi Suganthy, Saito Toshiyuki, Sawutti Alimjan, Miyaki Takayoshi, Itoh Masahiro, et al. Light-weight plastination. *Ann Anat*. 2008;190:428–431.
7. Ripani M, Boccia L, Cervone R, De Vargas Macciucca M. Light microscopy of plastinated tissue, can plastinated organs be considered viable for structural observation. *J Int Soc Plast*. 1996;11:28–30.