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Preparing Eye Slices with Biodur P40

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The aim of the experiment is to prepare slices of the eyeball, that are safe for the health of the trainees, that are durable and give an exact idea of the macrostructure of the eye. We used 14 pig and 4 calf eyeballs of animal corpses and prepared them with Biodur P40 polymer. We get the best slices by freezing (-25°C) before fixation of the biological material. Plastinated eye slices are difficult to prepare, but they are practically everlasting.

Eye plates are safe for human health and can be used for educating eye anatomy of the students and residents. Treating of eye plates can be done using the classic technology of the author of the plastination method but modified according to the particularities of the specific anatomic preparation.

Key words: Plastination, Biodur P40, eyeball, anatomy, eyeslices.

Introduction

Biodur P40 and old Biodur P35 are contemporary plastination materials used for preserving brain slices [5, 10, 13]. Treated with them parts of brain are practically everlasting and safe for the human health [3, 6] . The obtained plates demonstrate the macrostructure of the white and grey matter and their proportion [1, 8] and they are suitable for medical student and post-graduate students [4, 7, 12]. We experimented to plastinate the eyeball using Biodur P40. Plastination of eye slices has not been performed worldwide so far.

Aims and tasks

The aim of the experiment is to prepare slices of the eyeball, that are safe for the health of the trainees, that are durable and give an exact idea of the macrostructure of the eye.

In order to realize the described aim we had the following main tasks:

1. To choose a suitable biological material;
2. To define the method of preparing the slices of the used biological material;
3. To fix the stage of the plastination procedure most suitable for performing the cuts.
   To define the optimal duration of the stages for plastinating the slices.

Material and Methods

We used 14 pig and 4 calf eyeballs of animal corpses that are most suitable for the purpose according to the size, structure and availability.

The chemical and physical agents needed for treating the biological material are:

Fixators – 5% water solution of formaldehyde (methanol by IUPAC – HCHO);
Dehydrant – acetone 98-100%;
Impregnator – Biodur P40;
Hardener – UV.

The slices were prepared in different stages of the plastination process – before fixation (10 cases), after fixation (2 cases), after dehydration (1 case), after impregnation (1 case). After the fixation we froze the eyeball (25°C) and using eye scalpel (9 cases) or a special cutting tissue machine (1 case) we cut it into plates 3-4 mm wide.

We fixed the eye plates with 5% water solution of formaldehyde (–25°C) for 72 hours and after that we put them into cold acetone (–25°C) for 12 h. The technique used after the fixation of the biological material is analogical but we put the eye slices directly into cold acetone (–25°C).

The prepared slices were impregnated using a standard plastination technology with Biodur P40, submitted by Gunther von Hagens(1986) [9] for plastinating brain slices, modified according to the specificity of the eyeball(fig. 1). We put the eye plates in a container with cold Biodur P40 (–25 °C) and under constant observation we slowly increased the vacuum until the signal bubbles disappeared. Because of the small capacity of the wall of the eyeball the stage of impregnation continued (including the pauses) for about 2 h (10mmHg=13 mbar)

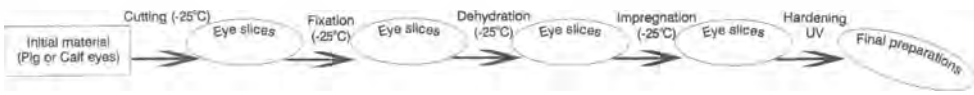

Fig. 1. Scheme of preparing the eye plates with Biodur P40

In the phase of "hardening" we first put into the matrix a thin (1-2 mm) layer of Biodur P40 and we put it under the influence of UV radiation (200W/30 min). Over the semi-hardened layer of the polymer we put a dehydrated slice of the eyeball and using an anatomic pincet we shaped it so that more details could be observed. Carefully and slowly we filled the matrix with new Biodur in order to cover the eye slice 1-2 mm. We irradiated the ready matrix with UV light (200W/30 min) constantly controlling the quality of the hardening.

Results and Discussion

We performed a subjective visual assessment of the anatomic preparations of the eyeball.

The preparations had a satisfactory quality and could be used for educating anatomy of the eye.

The best eye slices were the ones made before the fixation using scalpel despite the technical difficulties in cutting the eyeball.

The plates prepared after the fixation with 5% water solution of formaldehyde had worse quality due to the lower level of hardening of the biological material. This is according to investigations of other authors [2. 9].

The dehydrated eyeball was tearable despite the low temperature (–25°C), that is the reason why we didn't get equal cuts. The same result but in bigger size we got when we impregnated with Biodur P40 biological material.

The periods of step by step treating of the eye slices were significantly shorter compared to the analogical procedure in preparing brain plates [9, 13], which can be explained with the smaller size of the material. The other difference is that when plastinating the eyeball we avoided the stage of "immersion" [5], and after the dehydration we directly impregnated.

The phase of "hardening" is particularly difficult and important because the Biodur P40 is more sensitive to any change in the condition in this stage. To make a valuable preparation we stuck to the guidelines received in a personal conversation with Gunther von Hagens (1996) – the author of the plastination method. The appearance of cracks or darkening of the plate is a sign of quick polymerization and implies short interruption of the radiation, followed by lowering the power of UV radiation [11], and when the hardening is insufficient we need extension of the stage. The power increasing is not desirable because better results are received when using lower radiation.

Conclusions

1. Plastinated eye slices are difficult to prepare, but they are practically everlasting.
2. Eye plates are safe for human health and can be used for educating eye anatomy of the students and residents.
3. We get the best slices by freezing (–25°C) before fixation of the biological material
4. Treating of eye plates can be done using the classic technology of the author of the plastination method but modified according to the particularities of the specific anatomic preparation.

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