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Eyeball Plastination with Polyester Co-Polymers

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Polyester co-polymers are contemporary plastination materials, used for brain preserving. The aim of the experiment is to investigate the possibility of preparing exact anatomic models of whole eyeballs, which are safe for the health of the trainees and durable and resistant to mechanical trauma. We used 2 pig and 2 calf eyes of animal corpses and some chemical and physical agents: Fixators – 5% water solution of formaldehyde (methanol by IUPAC – HCHO); Dehydrant – acetone 98-100%; Impregnator – polyester co-polymer Hardener – UV.

Plastinated with co-polymers eye preparations have a good quality and mechanical resistance. The preparations are safe for the human health and are practically everlasting, that is why they can be used for teaching students of medicine and ophthalmology residents.

Key words: Plastination, Polyester co-polymers, eyeball, anatomy.

Introduction

Polyester co-polymers colored or not colored [1, 2] are contemporary plastination materials, used for brain preserving [8, 9, 13] or preservation of other body partes [3, 4, 6, 12]. The parts of the brain treated with it are practically everlasting and safe for human health.

A combined method is used to plastinate a whole eyeball, offered by the same authors (1997), using two plastination materials- polyethylene glycol and Biodur S10 [5]. The preparation made by using this method is soft and elastic as well as harmless to human health but it is not resistant to mechanical trauma [5]. That is why we assume that polyester co-polymers are more suitable for plastinating eyeball in order to make a preparation with greater resistance [10, 11].

Plastination of eyeball with polyester co-polymers has not been performed worldwide so far.

Aims and tasks

The aim of the experiment is to investigate the possibility of preparing exact anatomic models of whole eyeballs, which are safe for the health of the trainees and durable and resistant to mechanical trauma.

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

1. To choose an appropriate biological material
2. To choose the optimal duration of the stages of plastination of the eyeball.

Materials and Methods

We used 2 pig and 2 calf eyes of animal corpses because their size, structure and availability are most suitable for the purpose.

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 – polyester co-polymer
Hardener – UV

The plastination material was treated by using a standard technology with polyester co-polymers, offered by Gunther von Hagens(1994) for brain plastination, modified according to the eyeball specificity. We used "hylase" for the liquification of the vitreus body as in the combined method for plastinating the eyeball (1997).

Results and Discussion

The preparations we made have better quality and mechanical resistance compared to the ones prepared using the combined method (fig.1 and fig.2) and can be used for teaching eye anatomy. This result is according to other authors [10, 11].

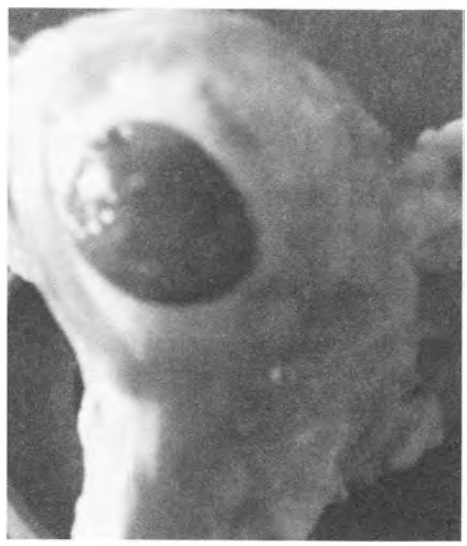

Fig. 1 Eye, treated using the combined method with Biodur S10 and polyethylene glycol

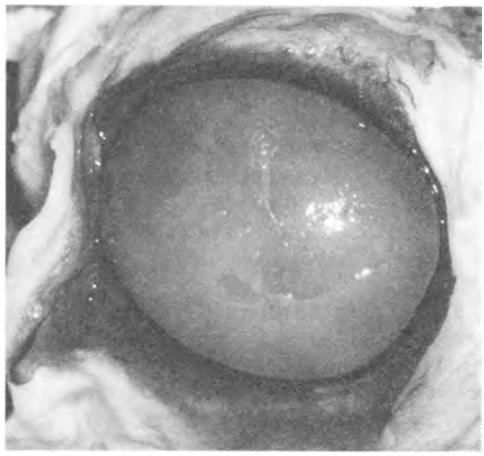

Fig.2 Eye, prepared with polyester co-polymer

It is not well defined in this case when to fixate and dehydrate as with eye slices, because the eventual damage of the retina does not matter for the final preparation.

In both methods – combined and plastination with co-polymers, the danger of shriveling of the cornea exists in the stage of dehydration. We compensate the shriveling by injecting plastination material in the anterior eye chamber, polyethylene glycol in the first method and polyester co-polymer in the second one.

We manage the shrinking of the eyeball after the liquification of the vitreus body with "hylase" in the same way but here comes the difficulty with hardening the polyester co-polymer because of the incapability of UV light to penetrate inside the sclera.

Before the impregnation we do not use the stage "immersion" which is analogical to the preparation of eye slices, but the impregnation itself we perform at room temperature, not at –25°C. This is synchronized with the investigation of Sora et al (1999) [6].

We harden the material using UV light (200W/180 min), as we constantly control the quality of the preparation. Unlike the hardening when preparing eye slices, we do not observe cracking of the material, because the proportion between the polyester co-polymer and the biological material is in favor of the biological material.

After the stage of drying the preparation we have to put it in an open container under the sunlight for several weeks because the impregnation material is not dry yet in the end of the procedure as the UV light does not penetrate through the wall of the sclera. To harden the material in this case we rely on the fact that heat also initiates reaction in the polyester co-polymers and they harden for a few weeks even though more slowly.

The preparation that we make is hard and non-elastic but more resistant to mechanical trauma. It is safe for human health.

Conclusions

1. Plastinated with co-polymers eye preparations have better quality and mechanical resistance compared to the combined method.
2. The preparations are safe for the human health and are practically everlasting, that is why they can be used for teaching students of medicine and ophthalmology residents.

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