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RESEARCH ARTICLE

Light-weight plastination

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Summary

Plastination is an excellent technique which helps to keep the anatomical specimens in a dry, odourless state. Since the invention of plastination technique by von Hagens, research has been done to improve the quality of plastinated specimens. In this paper, we have described a method of producing light-weight plastinated specimens using xylene along with silicone and in the final step, substitute xylene with air. The finished plastinated specimens were light-weight, dry, odourless and robust. This method requires less use of resin thus making the plastination technique more cost-effective. The light-weight specimens are easy to carry and can easily be used for teaching.

Introduction

Plastination is a process of preservation of anatomical specimens by impregnation with curable polymers like silicone, epoxy or polyester resins. Plastinated specimens are dry, odourless and require minimal aftercare. However, the cost of resin is an important factor in plastination procedures. Handling and mounting the heavy plastinated specimens is sometimes cumbersome. In this paper we describe, for the first time, a cost-effective method of plastination producing light-weight, rigid, good-quality and durable specimens.

Material and methods

The procedure was tested with a 3.5-kg pike in a preliminary study. The half pelvis, a kidney, heart and shoulder of a 94-year-old female, a lung from a 60-year-old male and the whole body of a 65-year-old man who had donated their bodies for plastination to the Institute of Anatomy, Leipzig were used for this study. The human bodies were fixed in alcohol and preserved in a solution of thymol, alcohol and water. Then the bodies were

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dissected. During dissection, some structures of the whole body were coloured (Steinke, 2006). After dissection the bodies were precooled, shock frozen, freeze substituted with acetone and degreased at room temperature for a minimum of 1 week. Then the specimens were transferred into a mixture of polymerizing silicone (S) and technical xylene (X), (Baker, Deventer, Holland) at different compositions according to Table 1. The ingredient S was prepared by using S10 (silicone)+S3 (hardener) = 100+1 (Biodur, Rathausstr. 18, 69126 Heidelberg) and vacuum impregnation was started. At 25 mBar, the acetone intermedium was slowly replaced by the S–X mixture, over a minimum of 2 weeks. The procedure was finished, when the mixture was free of little gas bubbles, correlating to the specimen size.

The specimens were taken from the exsccator and treated by S6 gas-hardener (Biodur) in a gas chamber for a minimum of 2 days. The residual xylene was removed from the specimens under high vacuum by mounting them in the final pose into the exsiccator. At this time, vaseline was injected into the joint cavities. The specimens were evacuated for 1 week or longer depending upon the size of the specimen. The process was stopped when the vacuum reached 2.5 mBar or below. Now the valve was very slowly opened to allow air into the exsiccator. Finally, the specimens were mounted on a supporting device. The plastinates were immersed in water for some time and then checked for decay of the specimens over a period of months. If necessary, the muscles were coloured with wood paint (OBI Classic Dauerschutz-Lasur) and the surface of the specimen was sealed with silicone.

Results

After plastination, the pike was very rigid with no colour change. The skin was water proof, but water penetrated the specimen at the cutting edge. The weight of the pike after plastination was only 496 g, that is about one seventh of its original weight. The half pelvis, kidney, heart and shoulder were rigid. The light plastinates were brightly coloured in comparison to plastinates prepared according to standard procedures (Figures 1–6). The shoulder joint specimen and the organs were water proof, but the pelvis needed sealing with silicone after plastination. The hip joint was flexible while the shoulder joint was stiff. The cut surface of the muscle of the shoulder plastinated using standard technique showed the space between the muscle fibres filled with silicone (Figure 1), while the space between the muscle fibres was air filled in the light-weight plastinate (Figure 2).

The organs in the light-plastinated specimens (Figures 4 and 6) could be seen more clearly than those in the specimens plastinated using the standard technique (Figures 3 and 5). The lumen of the vessels and alveolar spaces of the lungs are obvious in the light-plastinated specimen (Figure 4). The same was true for the internal

Table 1. Low-weight plastination

Specimen	Steps of preparation	Plastination with xylene and silicone (X+S)	Results
(a) Pike	Precooled at 3 °C; shock freezing at −85 °C in acetone+water = 85+15; freeze substitution at −25 °C in pure acetone	5+1	Very rigid, no colour change, water penetrates at the specimens cutting age, skin waterproof, weight reduction 3.5 kg to 496 g, like freeze-dried material
(b) 94 ♀ half of pelvis	Alcohol fixation, thymol conservation, dissection, then treated like (a)	4+1	Rigid, muscles rigid, bright colour, hip joint flexible, surface like cardboard, waterproof only when sealing with silicone (Figure 1)
(c) 94♀ kidney		3+1	Rigid, very stiff, bright colour, waterproof
(d) 94 ♀ heart		2+1	Rigid, less bright colour, danger of fissures under tension, waterproof (Figure 2)
(e) 94♀ shoulder	As (b–d), joint cavity injected with vaseline	5+3	Rigid, bright colour, muscles rigid and less elastic, waterproof, stiff joint
(f) 65 ♂ whole body	As (b–d), additionally coloured during dissection, mounted on movable pillars	2+1	Muscles less rigid and elastic, inner organs and hearth rigid, stiff joints, less bright colour, weight reduction 55 to 18.6 kg, structures coloured