

A COMPENDIUM ON RECENT ADVANCES IN ANATOMY MUSEUM TECHNIQUES

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Abstract: *Teaching methodology has been revolutionized with more reliance on various models, charts, specimens and internet to enhance the learning and experiences of new concepts. Anatomy museum forms the integral part of the Anatomy department. It comes under the category of science museums as they display various anatomical structures of scientific interest to medical students. The museum is not merely used for conversation, storage and display of items but it should also educate. Now these days many museums have been developed by non-medical persons. Such museums usually lack the quality, because of noninvolvement of anatomist. The main idea behind this article is bring out a low-cost museum to cater needs of students in acquiring knowledge and to understand the subject.*

Index Terms: *Museum, anatomy, science, specimens, models*

Introduction

A museum is an institution that houses and cares for collection of various artifacts and other objects of scientific and artistic importance.^[1] A good museum needs lots of planning and dedication before one start preparing. The basic need for a museum is it should be well ventilated with natural lighting. The anatomy museum consists of wet specimens, dry specimens, charts, models etc. The topics of interest like comparative anatomy, genetics, cross sectional anatomy and specimens with variations can also be added. The wet specimens are arranged according to regions like upper extremity, lower extremity, thorax, abdomen etc. Some specimens are arranged under different headings like osteology, neuroanatomy and embryology. It is essential that the original shape and color of specimen should be retained. Now days making museum has become more commercial, developed by non-medical persons, lacks quality because of nonintervention of Anatomists.

Racks

The wet specimens along with the jar are placed on racks; can be customized in different ways to suit our needs and for the better looks. Now a day the racks can be designed with adjustable shelves depending upon the height of the jar. An illuminated chamber can be attached to the rack so that the picture of the specimen that must be displayed along with the writing can be printed on the photo paper, which can be placed on the illuminated chamber for better viewing. The racks can be designed in different shapes.

Specimens

Specimens that are dissected out should be from a well embalmed body. The body should not be too obese or too thin. It is better to select the body with average built. Working with human anatomical specimen requires respect and sensitivity.^[2] The color of structures can be retained using the color fixing fluid by Aegerter (1941). The fluid has the following composition Sodium chloride - 140gms, Sodium bicarbonate -80gms, chloral hydrate - 625gms, Formalin (40%) - 512 ml and 20 liters of water. The specimens are usually preserved or mounted in Kaiserling I and II solution. One effect of using either 10% formalin or Kaiserling I is that natural colour is lost during fixation. This may be restored in two ways:

1. Soak the fixed tissue in 80% ethanol until the color returns, then immerse in Kaiserling II in a sealed jar.
 2. Immerse in kaiserling II in a sealed jar after adding a small amount of potassium hydrosulphite. The color slowly returns over a few days.
- Kaiserling I: Water 2L, Strong formalin - 400ml, Potassium nitrate- 30g, potassium acetate -60g. Kaiserling II: Water 2L, Potassium acetate -200g, Glycerol-400ml, Formalin 200ml.

Mounting of Specimens

Many soft specimens should be mounted with support such as plastic sheets and plaster of Paris or else they can get flawed.^[3] Specimens before mounting should be examined thoroughly so that they are clearly visible. The procedure is as follows, the excessive moisture on the specimen is removed by patting it dry using a filter paper and 5gms of gelatin is mixed in 100ml of water and is coated on the specimen using a brush. By this the specimen appears fresh and connective tissue strands are hardly visible. Specimens like kidney, heart that are to be mounted is usually stitched to the plate of acrylic sheet or tied to a glass rod and if this is immersed in a larger jar the specimen is in a slanting position instead a small stand can be made with the help of the acrylic sheet and the specimen can be mounted on it.

Jars Used for Mounting of Specimens

The jars used for mounting is mainly made of glass and more recently the acrylic jars have come into existence. The acrylic jars made of imported acrylic sheets is most suitable for mounting in the present-day situation. The transparency of these jars is quite good, long lasting and affordable and can even be made in the department by a skillful technician. The only disadvantage is the leakage at the joint when it not done properly. This can be prevented by the following ways. The surface at the end before joining should be made sure that it is even and not serrated. The edges are joined by chloroform which acts like an adhesive.

Charts

Charts are not only meant for display but also are an important teaching aid. The charts are available in different sizes. With the technology so advanced one can make a beautiful chart. The picture used for making a chart should be taken from a standard textbook or from an atlas with international standards. The picture selected should be of academic interest, so that it can be used for teaching also. The picture is then scanned with high resolution or by drum scanning and then the picture is enlarged to the required size. In this case the picture quality is quite good, but the letters when enlarged might appear slightly blurred, this can be rectified by retyping the text using adobe photoshop software before taking the print out. Several modern museums are now using various computer based pictorial catalogues for educating the students.^[4]

Plastinated Specimens

Plastination is the process of long term preservation of perishable biological specimens. This technique was invented by German Scientist and Anatomist Dr. Gunther Von Hagens in 1977. This technique involves fixation, dehydration impregnation and hardening.^[5] Plastination with silicone compounds that yields excellent results are rubbery in consistency and unbreakable. Plastinates do not smell formaldehyde, thin section can be protected by this method and risk of infection is very minimal.^[6] Fixation or tissue preparation requires the specimens to be fixed in a 10% formaldehyde solution, this stabilizes the tissue and prevents autolysis. Dehydration of all biological specimens is essential as these specimens have a high-water content which needs to be removed for plastination. This is achieved by a process known as Freeze substitution where the specimens are placed in solvent at very low temperature. Forced impregnation is also done; the dehydrated specimens are submerged into the liquid polymer and placed under vacuum. The vacuum draws out the acetone from the specimen and the polymer, takes its place. The polymer filled specimen is placed into a chamber, where it meets hardener making the specimen dry to touch.

Plastination with Silicone Compounds

Silicone compounds that are available commercially are of different types, opaque, translucent and transparent. The transparent variety is useful for making whole organ plastination, sheet plastination and for the vascular injection techniques. The transparent variety is available commercially as RTV 615. This product has two parts; base and a hardener, for 100ml of the base, 10ml of hardener is added and mixed thoroughly.

Whole Organ or Sheet Plastination

The organ to be plastinated or the specimen for the sheet plastination is first fixed with 10% formalin and it kept in the acetone at normal temperatures and later the specimen is taken out and kept in fresh acetone in deep freezer. The quantity of acetone should be about ten times more than the volume of the specimen. The specimens are taken out and kept in the silicone base (RTV 615) without the hardener. This is kept in the vacuum chamber for forced impregnation for the silicone to impregnate inside the specimen. Once this is done, the hardener is applied over the surface. Slices and cross-sectional specimens are plastinated in the similar way. These specimens are embedded in the transparent silicone in the form of sheet. This is very useful for cross sectional anatomy (sheet plastination).

Luminal Cast Plastination

This method is useful to study the dimensions and architecture of different cavities of organs and to study various tubular structures (arteries, veins, ductal branches and their variations). The principle of this technique includes filling up the lumen with rubber silicon and removing the surrounding tissues by boiling method.^[7] Cast of the trachea- bronchial tree using goat lung can be taken by injecting the silicone sealant which is available commercially, before injecting the trachea along with the lungs is thoroughly washed with water, heparin and soap solution to remove the froth and blood from the lungs. After injecting the silicone, the specimen is kept for 2 days then the specimen is immersed in 10% KOH solution for tissue disintegration that leaves behind the cast of the tracheo-bronchial tree. Dry specimens like ear ossicles, bones like inferior nasal concha, lacrimal bone, ethmoid, hyoid bone etc., which are delicate and difficult to handle can be embedded with transparent variety silicone (RTV615) for easy handling.

Silicone Moulds

Silicone moulds can be made using the opaque variety mould resin. This product is also available into parts base and a hardener. Since this variety is of thicker consistency. A silicone diluent which is available commercially is mixed with base to make it thinner and free flowing. Cast which are difficult to take like vertebra and other structures can be taken easily by moulds made with mould resin. The silicone mould is highly elastic and can withstand high temperature and long lasting. To overcome various difficulties like direct contact use of paraffin wax is done.^[8]

Vascular Injection Technique

Vascular anatomy is very essential for the reconstructive surgery. With many techniques existing the dye or the compound used does not pass through the infra millimetric arteries or very small arteries. For these studies two types of silicone can be used RTV116 and RTV615. Artery to be studied is dissected and exposed. Red pigment is added to 100ml of silicone, RTV615 and mixed thoroughly till the whole solution becomes red in color. 10ml of hardener is added to above mixture and mixed thoroughly and kept in the vacuum chamber. The silicone compound devoid of air bubbles is taken in 50cc syringe. The nozzle of the syringe is inserted into the artery and the artery is tied with thread around the nozzle to prevent leakage and the silicone compound is injected slowly after injecting the artery is clamped and kept for 2 to 3 days for the silicone to harden. By this method the minute artery supplying the nerve can be easily visible. Using RTV615 is more complicated since it must be mixed with the color and hardener and use the vacuum pump to remove the air bubbles. This can be avoided by using RTV116 which is available commercially and red in color.^[9]

Anatomy Models

Models form the most important part of the museum. It brings reality to student's imagination. Using models, the three Dimensional and two-dimensional views can be demonstrated. The models usually are made with the help of Plaster of Paris, wood, thermacol, fibroplast, ceramic

etc. Normally the model is made first using clay a mould is taken using Plaster of Paris. The cast is taken either by using Plaster of Paris or with fibroplast. The models painted with oil paint to get a professional look, the models can be painted with spray gun.

Fibroplast models

Fibroplast models are quite good compare to models made of Plaster of Paris, since these models are not heavy and unbreakable. Fibroplast models can be made using general purpose resin, chalk powder and fibre mat. The procedure is as follows a clay model is first with all the surface detailing. A release medium is applied on the clay model and a 2nd part mould for this model is taken using Plaster of Paris. The release medium is applied on the mould where the cast is to be taken. The required amount of resin is taken mixed thoroughly with 25% chalk powder and 10% hardener. This mixture when it starts hardening it is smeared over surface on the place where the cast is supposed to be taken; the fibre mat is pressed over the resin.

Wood models

These models are easy to make and are very useful for making cross sectional and two-dimensional models. These models are made using marine plywood, which is water resistant and long lasting. Advantages of these models are they are unbreakable and long lasting and can painted repeatedly and less expensive.

Ceramic models

Ceramic models are easy to make, inexpensive, strong and with excellent finishing. These models are suitable for making 2 and 3 dimensional models. The raw materials required for preparing these models are ceramic powder, chalk powder and liquid gum preferably fevicol. In addition to these, other materials like clay, thermacol or thick plastic sponge like material can be used to make the basic structure. To make hollow model first clay model is made and the two parts mould is made. The ceramic mixture is then applied; a cast is taken polished and painted.

Fabric models

The structures for which fabric models can be prepared very effectively are femoral sheath, axillary sheath etc; models of peritoneum reflections like falciform ligament; ligaments of uterus. Bones, muscles of hands, nerves, arteries and arches in hands can be prepared. Papers of various thicknesses, cloths like nylon or satin, rubber and plastic tubes are the basic requirements for the preparation of the same.

Conclusion:

Teaching anatomy faces inherent and contextual challenges as students must learn many new concepts and complex terminologies. Study of human cadaver is vital in the curriculum of medical science as it is the primary focus of practical classes. Many new techniques have been developed in the present era for the preparation of specimens aimed to enhance the better quality of education. So, keeping these factors in view it is necessary to focus on latest architecture of human anatomy in the forms of various charts, models, specimens etc. These effective teaching resources may help the students to learn and memorize the subject for a longer duration.

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