Original Article

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Augmenting the Visual Display of Museum Specimen Using Fabrica Acrylic Colors and Its Better Restoration

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Abstract

Background: Adding color to specimen presented in anatomical museum is a vital requisite to distinguish various structures as arteries, veins, nerves, muscles, ligaments, tendons etc. Here tactile discrimination is impossible for preservative fixed specimens sealed in jars. Besides the use of various coloring agents, protocols are developed for the color restoration with maximal long-lasting efficacy with instance, age and cost-effectiveness. *Method:* In our department we developed a protocol for coloring using readily available acrylic colors to color various regions and structures of anatomical specimen for visual enhancement. The specimens were than suspended in Kaiserling (I and II) preservative and stored in Perspex containers. *Result:* Institutional experience of handling specimen by preservation and imparting with readily available colors remain unchanged and displayed wet-specimen to their optimal elegance. *Conclusion:* This simple and easy method of coloring of specimen and the developed protocol for its longer restoration is immensely important in crafting a museum.

Keywords: Color; Wet Specimen; Anatomy; Museum**.**

Introduction

Early in the sixteenth and seventeenth centuries the Anatomical museums came into the picture. Human Anatomy is an investigative scientific stream that has wide spectrum varying in past from inspection and assessment of victims who were executed to the contemporary age of dissection of voluntarily donated bodies. It forms the bedrock substratum for the medical curriculum. Museum is an integral part of the Anatomy department and as in an excerpt by Fredrick Knox, without it the profession of anatomy would be in the state of an individual without a language [1]. The core rationale of a museum is to endow the students with a comprehensible visual exhibit with finest teaching quality within itself [2]. The display of each specimen in a museum is anticipated to not only have a pedagogical objective but also a supreme aesthetic appeal that ends up in making things apparent [3]. Variant factors involving trivial technological points are behind each flawless museum specimen. Execution of this demands a creative approach while planning and preparing the exhibits. Thus in incessant progressing museum technology came up varied means of compilation, preservation and presentation of museum specimen. Primitive manner of mounting the specimen in formalin as such with a monochrome tone was found to be nasty and ambiguous for understanding of the students leading them to be least engrossed. To discriminate and identify the structures most of them relied on the colored atlases in Anatomy. Thus it was concluded that coloring imparts a remarkable effect in visual interpretation of diverse anatomical structures.

To have a classical exhibit of prosected specimens to support teaching and learning of anatomy, we have formulated a novel cost-effective long-lasting method of coloring and preserving wet specimen with nominal upholding. The special emphasis was on augmenting the visual display of conventional Anatomy museum.

Material and Method

The Technique was carried out in the Department of Anatomy, All India Institute of Medical Sciences,

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Jodhpur (Rajasthan). The pre requisite for the procedure are commercially available acrylic colors (Brand: 'Camel' from Camelin limited), Type: Fabrica acrylic colors, different sized painting brushes, turpentine oil for clean-up of tint over brushes and routine dissection instruments. The entire modus operandi initiated from collection of specimen to mounting by means of Pulvertaft's modification of Kaiserling method [4]. The grossing of specimen was done initially by obtaining desired region cut largely followed by fine dissection at a centralized well-illuminated, ventilated clearing station. Specimen are immediately put into primary fixative after resection keeping volume of fixative twenty folds of volume of specimen with varying time for fixation depending on the size [5]. Ten percent neutral buffered formalin can be used for the primary fixation. Then it is shifted to Kaiserling I solution. The composition of various Kaiserling solution is

Table 1: Showing the solution and the composition

Solution	Composition
Kaiserling solution I (Fixing fluid)	Formalin (400 ml), Potassium nitrate (30 gm), potassium acetate (60 gm), tap water (to 2000 ml)
Kaiserling III (Mounting solution)	Glycerine (300 ml), Sodium acetate (100 gm), Formalin (5 ml), Tap water (to 1000 ml)

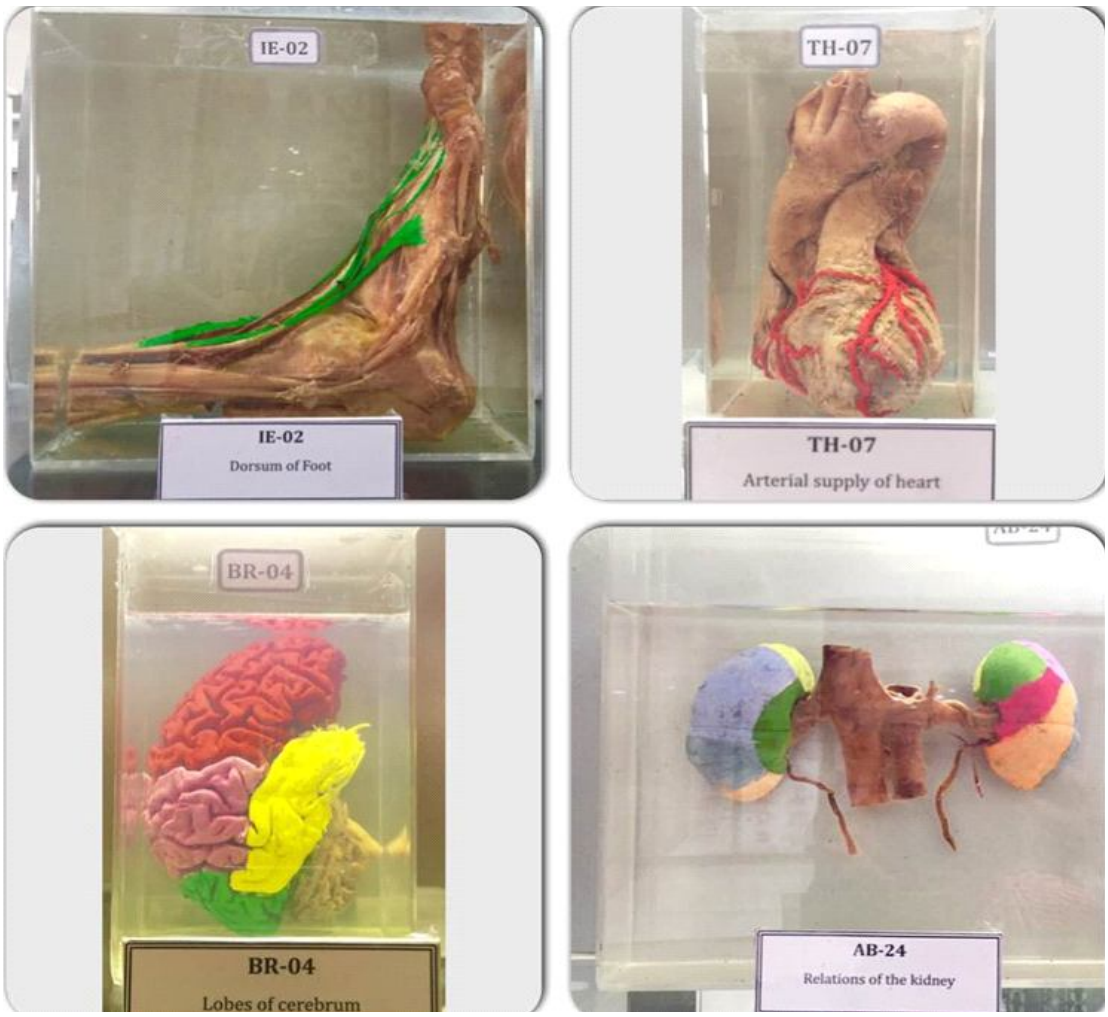

Fig. 1: Showing various colored specimen with better visual impact
IE-02: Green color showing Flexor tendons passing from leg to dorsum of foot
TH-07: Red color showing right and left coronary arteries & their branches
BR-04: Red: Frontal lobe, Pink: Parietal Lobe, Green: Occipital lobe, Yellow: Temporal lobe of superolateral surface of cerebral hemisphere
AB-24: Showing relations of Right and Left kidney. Yellow (both side): Suprarenal gland, Blue (Right): Hepatic area, Green(right): Duodenal area, Nude(right): Jejunal area, Light pink(left): Splenic area, Green(Left): Gastric area, Pink(left): Pancreatic area, Peach(left): Jejunal area, Blue(left): Colic area

summarized in table as:

For the further preparation specimen were kept for a day to dry up at room temperature. Blow dryer was also used for drying of viscera as Lungs, liver etc. Hollow organs and hilum of the organs were stuffed with cotton to absorb the excessive fluid. Complete drying is mandatory in the process as it prepares the surface of the structures to be colored. The structures should be well separated from each other as well as from underlying structure. That can be done by putting cotton in between and using forceps and glass rods. This also promotes early on drying of structures. An ample variant of shades of tint are readily available with commercially available fabric color packs but still other desired shades were also prepared by mixing. The classical color scheme was followed for painting as red for artery, blue for vein, purple of lymph nodes, yellow for nerves etc. Again the specimen was kept overnight for appropriate drying. When the specimens are retrieved they need scrupulous attention to minutiae of structure being actually mounted. The specimens were than suspended in Kaiserling mounting solution III, sealed and stored in the sealed Perspex containers. In case if the solution is not crystal clear it is preferred to filter it through a paper pulp. Cloudiness of the solution is by and large due to impurities in sodium acetate where instead of simple filtering; adding a saturated solution of camphor in alcohol is advised. Later on the containers were specifically labeled and organized cataloging was done.

Results

Institutional experience of handling specimen by preservation and imparting with readily available fabric colors remain unchanged and displayed wet-specimen to their optimal elegance.

This has not shown any visible changes in color for the last 2-2.5 year. To apply fabric color was extremely easy while coloring as it swiped smoothly on the surface with no lumping.

Discussion

The most common complexity encountered in museum is inability to distinguish between the various structures in given specimen merely by looking to it without touching. For example nerves, arteries and veins are not easily differentiated in conventional mounted specimens. Also to make the museum look more alluring, attractive and informative for all genres of visitors, the coloring is considered important. A simple lung specimen cannot give the idea of bronchopulmonary segments which a one with different colors for each segment can easily offer. The same works well for showing specimen the structures related to a particular region of it. Various workers reported in literature have worked on numerous regimes for coloring and preservation of wet-specimen, using different varieties of colors. In early sixteenth century the spirits of wine were discovered as the classic mean of preservative by Robert Boyle. The specimen preserved by spirit remained in excellent even after twenty decades and this practice is reported to be continued in literature up to nineteenth century. Here the major drawback related with the procedure was the inability of the preserved tissue to endure any subsequent staining.

In the mean time Melnikow-Raswedenkow, Jores and Kaiserling in 1896 working autonomously, revealed a procedure involving formalin with its effective fixative property. Here color restoration was done by adding ninety-five percent alcohol besides further use of glycerine in preservation. Ultimate modus operandi perpetuated by Kaiserling was extensively time-honored globally [6,7,8].

Literature reported various workers used diverse practices to color museum specimens. Among most pioneers was Congdon E. D. to use albuminous paints in early nineteenth century [9].But the discolouration resulted in due course. Thereafter, came the concept of injecting various substrates as silicone, gelatin, latex or epoxy etc. in the vessels [10-15]. Lacquer has been used earlier as well. Saunders established the utilization of lacquer in coloring the wet specimens. The procedure used in technique was sensitive, time consuming, and hence needs a trained individual. With time yellow coloration was observed and gelatin was found to liquefy, resulting bubbles. It has its own pros and cons as it worked well for comparatively outsized vessels. The minuscule ones showed imprecise hazing and it was readily washed off [16].

Robert W. Henry, Larry Janick, and Carol Henry used silicon to color plastinated specimens [17]. Utilization of mere plastinated specimens is a compromise caused of its precincts in terms of tactile and poignant emotional familiarity that is endowed with the wet specimen. Regarding the methods of color maintenance, most commonly used primary fixative is ten percent formaline saline [5]. Formalin preservation soon lost its importance due to associated irritable odor and unrealistic appearance in routine fixed specimen. The luminal architecture, dimensions and branching pattern etc. were impossible to

perceive in these single toned specimens. Various workers bespoke about different methods for coloring and its restoration for paramount domino effects. The majority of these methods were modification of the method used by Kaiserling in his early work in 1900 [18]. The fundamental apprehension of his method was on the importance of the elimination of air and the impediment of acid formation in the medium.

It comprised of three solutions as: Fixing, restoring and mounting fluid. Later, Pulvertaft further altered the solution and came up with the novel concept of restoring color. He supplemented a reducing agent i.e. sodium hydrosulphite to the mounting fluid. Excellent results which claimed the tint to be almost as such even after more than three decades, encouraged workers globally to induce more techniques in this arena [5]. Pulvertaft method was subsequently modified in various combinations by Wentworth in his subsequent series of work over the years [19-22]. Here the focal modification was exclusion of glycerol from the mounting solution. Kaiserling (1900) and Wentworth (1938) had fundamental apprehension concerning maintenance of pH of the medium [18,19].

Still, the color of specimens in Kaiserling's fluid left much to be desired and fading sets in a short span. The method was altered by Klotz and Maclachlan after couple of years [23].Various other compounds as carbon monoxide used by Schultz converted hemoglobin to carboxyhemoglobin [24].

Romhanyi G gave the concept of formation of haemochromogens in previously formalin-fixed specimen. The age old pragmatic view got a new-fangled direction. This work productively gave exceptional results for ten decades as reported in literature. Besides its advantages the hands-on workers claimed the glycerine deficient solution to be miserable to work on. Thus trivial modifications as per requisite turned it be an excellent solution for coloring and its restoration [25].

Wentworth later on came with the idea of omitting glycerin from the mounting medium. This was an economical attempt, but reduced the refractive index of the medium and eventually leading to loss of brilliancy [21].

Carbon monoxide has also been employed as a color-retaining agent, which gave luminous color distinction, but entails the risks of poisoning and explosion [24]. These may be avoided by the modifications of Robertson and Lundquist [26]. The method is also described by Lewis and Gaines [27]. Israel and Young recommended the use of pure liquid paraffin for reducing discoloration [28] but it resulted in spurt in cost.

Therefore in the series, our formulated procedure is highly recommended for procuring colored museum specimen in Anatomy. The cautions taken during the procedure were faultless drying of the desired part before painting, time period of exposure to various fixative and mounting medias. Cost-effectiveness, easy application, long lasting color restoration etc. are the common exquisiteness of our institutional experience.

Conclusion

Coloring made the monochrome specimens more beautiful and lively. The coloring by this simple, economical and long lasting method will certainly help the museum curators to create effectual anatomical specimen. The visitors of various sorts ranging from layman to medical students as well as experts will certainly have an augmented visualization and idea of structures in a glance. Crafting a museum with brightly hued long-lasting specimen creates a visual orientation by its polychrome effect on observer and can be of great help in medical education. This can be of great help in improvement of medical education and enthusiastic learning of the subject.

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