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Museum techniques in oral pathology

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Abstract

The need of preserving pathological material has never been higher than it is right now, as the development of novel, effective therapeutic approaches is completely altering the way that sickness is perceived. It's fascinating to stroll through any museum that has been around for a century and realize how many specimens relate to illnesses that are either uncommon or never seen at necropsies these days, or that, when they are, are significantly altered by treatment. Pathological museums are in part historical, representing the pioneer work of diagnosticians and therapists. The present review is an insight on oral pathology museum and its preparation for future generation.

Keywords: Museum techniques, oral pathology, formalin, grossing

Introduction

A museum is defined as 'a nonprofit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment - Statutes of International Council of Museums^[1]. Like a well-prepared histology, a successful museum specimen depends on a number of small technical details and requires an attractive presentation^[2].

History

John Hunter (Father of Modern Surgery) will stand out for all time not only as a famous surgeon-pathologist but as one of the first of the great exponents of the experimental method in medicine.

In 1980's a shift of paradigms happened in museology.

Wilcomb E. Washburn made emphasis that museum work should be put on information rather than on objects.

Finally museums were no longer thought of as being repositories of objects only but as 'storehouse of knowledge as well as storehouse of objects'.

Types of Museums

1. Encyclopedia museums
2. Society museums
3. National museums
4. General and local museums
 - a. Open air
 - b. Working
 - c. Site
 - d. Virtual

Objective of the museum

1. Provide a running visual revision of high-end teaching quality which has the advantage of always being open.
2. The demonstration and exhibits of the museum should have an aesthetic appeal as well as pedagogical purpose and should be designed to make things clearer^[3].

Exhibits in oral pathology museum

1. Head and neck specimens displayed systematically along with the photomicrographs of its histological slides.
2. Relevant clinical photographs and radiographs.
3. Various kinds of unique microscopes, casts and models of deciduous, mixed and permanent dentition along with anomalies, natural and carved tooth specimens and informative posters^[3].

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General guidelines for setting up of a museum

- Layout of the museum should be present at the entrance along with specified timings for the visitors.
- Guidelines to the visitors should be displayed
- A data on the total number and type of specimens on display should be put up at the entrance and has to be updated periodically.
- A catalog or brochure should be provided for the visitor to guide in navigation of the museum
- Specimens need to be arranged system-wise
- Museum jars to be labeled and the labeling should be visible to the public.
- A book should be kept for feedback and future suggestions ^[4].

Importance of a museum

- Useful as teaching aid for students
- Educative tools for public
- Preservation of uncommon specimens
- Archival collection of specimens that depict history
- Preservation of tissue as evidence in forensic field

Requisites of a museum

- Large, well-illuminated room. Fluorescence lighting is preferred
- The museum room should be spacious enough to display all the specimens systematically
- The entire area of the museum should be smartly utilized with convenient space for visitor navigation
- Shelves for systematic display of specimens
- Tables, chairs and white boards for teaching purposes
- A curator's room with exhaust fan attached to it
- Museum should be preferably near the entrance of the institution so as to be the center of attraction to the visitors ^[3].

There are different types of museum techniques. They are as follows**1. Conventional**

- a. Wet mounting
- b. Informative photos and charts

2. Specialized

- a. Maceration of bones
- b. Mounting of calculi
- c. Mounting of transparent specimens
- d. Whole organ mounting
- e. Injection techniques

3. Advanced

- a. Plastination
- b. Virtual museum

Methods of mounting the specimen

1. Reception
2. Preparation

3. Fixation
4. Restoration
5. Preservation
6. Presentation

1. Reception/Collection of the specimen

A centralized collection station for all the specimens should be established. Two major sources of specimen may be postmortem/autopsy specimen and surgical material from operation theater.

Specimens should be received with complete details of the patient/ lesion. Also the date and time along with a unique museum reference number should be mentioned so as to avoid any confusion.

An ideal specimen is received fresh in unfixed state ^[5].

2. Preparation of the specimen

Preparation of the specimen is carried out in the curator's room. It should be well illuminated, ventilated and should be equipped with all the apparatus ^[6].

Grossing

The specimen may be grossed either prior to or after fixing. Grossing the larger specimen when it is still fresh and the smaller specimen after fixing is optimal. The details of the lesion: number, size, shape, color, consistency, weight, any cystic changes, necrosis, hemorrhage in the specimen should be recorded. Cut surfaces should be smooth and even.

Saline is most preferred over tap water to wash the specimens as contact with tap water causes hemolysis.

Smaller cysts should be filled with a clear acrylate to maintain the patency of the cystic lumen. Photographs of fresh or fixed specimens are captured to aid in documentation of pathologic lesions.

Radiographs aid for radiologic-pathologic correlation. These specimens include bone lesions, calcified soft tissue masses, lesions with embedded tooth, radiopaque foreign bodies, ducts /vessels after injection of radiopaque material and for locating lymph nodes in radical neck dissection specimens ^[3].

3. Fixation of the specimen and color restoration

Following surgery, specimens should be placed in a primary fixative as soon as possible, with the fixative's volume exceeding 20 times the specimen's volume. The length of the specimen determines how long it takes to fix. For every millimeter of tissue thickness, one hour is needed.

The specimen can be directly fixed in Kaiserling fluid No. I. fluid or transferred to a Kaiserling fluid No. I fluid after initial fixation with 10% neutral buffered formalin. Injecting the fixative is necessary for larger specimens to ensure consistent penetration. Cystic cavities that have not yet opened should be filled with cotton wool; if they have, fixative should be injected.

Composition of Kaiserling fluids and their importance**1. Kaiserling I solution - For fixation**

Composition:

Formalin- 1 liter

Potassium acetate - 45 gms

Potassium nitrate - 25 gms

Distilled water- make up to 10 liters

2. Kaiserling solution II - For color restoration

Composition: 95% Alcohol.

Rejuvenator solution

Pyridine - 100 ml
Sodium hyposulphite - 100 gms
Distilled water - 4 liters

3. Kaiserling solution III - For Mounting**Composition**

Potassium acetate -1416 gms
Glycerine - 4 liters
Distilled water - Make up to 10 liters
Thymol crystals added to prevent moulds

The specimen is carefully cleaned under running water. In an emergency, No. II fluid can be used to restore color (e.g. for photography). It's important to limit how long you spend in this solution because prolonged exposure to alcohol will permanently bleach the skin.

After further wash under running tap water, the specimen is added to solution No. III. It's crucial to consider the mounting fluid's (number III) pH. At pH 8.0, colors could be effectively kept, but if the pH shifts, they usually disappear. Therefore, N/1 sodium hydroxide is used to bring the pH of this solution down to 8.0. Prior to the jar being sealed, sodium hydrosulfite is added right away ^[5].

4. Procedure for mounting of specimen

Requirements: Specimen to be mounted, Perspex jars, nylon thread, Perspex cement, long needle, Kaiserling fluids III and specific label.

Initially all museum specimens were mounted in cylindrical jars. Replaced by rectangular glass jars covered by rectangular plates. Perspex jars are now universally preferred over glass jars for mounting as they are break resistant.

For the purpose of mounting, the specimens are laid on a flat waterproof bench in the position in which they are to be mounted. Measurements of the specimen is done allowing 1 cm clearance at the top and sides and 2 cm at the bottom. The depth of the specimen is measured, and approximately 5 mm added for the center plate. Suitable Perspex jar is then chosen for mounting.

The specimen is arranged in the desired position, stitched onto the center plate using nylon thread.

The specimen is then placed inside the jar after mounting fluid has been poured in to within 1 centimeter of the top. Using a broad-bladed spatula, air bubbles caught between the specimen and center plate are freed, and the mounting fluid is then poured into the jar.

After drying off the top of the box, Perspex cement is applied. After 30 seconds, the excess perspex cement is carefully removed and the lid is gently placed in place. A lead weight is applied and left for at least an hour after an additional thirty seconds. Perspex cement is used to seal the lid's holes after 48 hours after all the air bubbles escape out of the jar ^[6].

A novel method for coloring and labeling specimens in the museum

Nail polish has been used as a coloring agent in dry specimens and also in fixing colored wet specimens. After the paint is dried clear nail polish with amyl acetate in a 1: 1 ratio is applied on the painted areas. This is done using a paint brushes.

Special method for mounting of the tooth specimen:

Initially the tooth specimen is immersed in hydrogen

peroxide for a day to remove stains. Following this it is attached to the glass slide using acrylate glue /DPX to facilitate handling and preservation. Glass slide with attached specimen is then inserted into small perspex jar, labeled and displayed.

Specialized museum techniques

These include the following: (Table: 1)

Health hazards and safety measures

Infections, chemicals that may be combustible, poisonous, allergic, or carcinogenic, electrical and physical risks, wounds, and needle stick injuries are the most frequent types of health hazards in the museum step-up. Potentially biohazardous materials in the workplace include bone dust and crumbles and fragments. Formalin is extremely harmful. However, acute exposure to formaldehyde can result in a number of health problems, including skin, nose, throat, and eye discomfort. Furthermore, long-term exposure can cause asthma and specific cancers (such nasopharyngeal). According to occupational safety and health administration requirements, all tissues must be regarded as potentially dangerous and all-encompassing safeguards must be implemented. It is necessary to take appropriate precautions against infection, such as wearing facemasks, disposable gloves, and eye protection. Reduce your exposure to chemicals as much as possible, and dispose of your protective equipment properly. The lab staff should routinely wash their hands and disinfect the instruments to prevent the transmission of illness ^[3].

Recent advances in museum technology**1. Plastination**

Greek word – Plassein- 'To shape or to form'

It's a process of long-term preservation of biological tissues in a dry, odorless, easily handlable and storable manner. It's a cost effective, durable and stable method.

Principle: Substitution of water and lipids in the specimen by a curable polymer.

Application in oral pathology: Plastination of cysts and tumors ^[7].

Desirable properties of polymers

- Polymer should be easy to handle, economical and freely flowing in the unseasoned state.
- Its refractive index should not match that of the tissue.
- Mixture of resin and activator should provide flexible timing for manipulation.
- The polymer should be curable even when present in the tissue.
- Mechanical properties should impart a natural appearance to the specimen as well as make it firm to allow grinding.

Routinely used polymers include**Silicone, Epoxy resin, Polyester resin**

Bhavna *et al.* have recently conducted a study with attempts to plastinate selected oral specimens using four different methods for preserving them in pathology museums. The 4 resins used were plastic cups, epoxy resin, polyester resin, and polyester diecast resin. Their results concluded that polyester dies cast resin provides the best results among the indigenous low-cost methods for plastination followed by polyester resin (GP resin), epoxy resin and plastic cup

medium [7].

Another study using only epoxy resins were conducted by Snega Thamilselvan *et al.* They concluded that the usage of epoxy resin to preserve museum specimens can be beneficial in educational institutions. But one of the major drawbacks was that the specimen cannot be retrieved any further for future studies [8].

Advantages and Disadvantages of plastination: (Table 2)

2. Virtual museum

Synonyms: Electronic museum, Hypermuseum, Digital-

museum, Cybermuseum, Web-museum.

It's a place where there is collection of digitally recorded images, sound files, text documents and other data of historical, scientific or cultural interest that are accessed through electronic media.

An important step towards the audience-driver or visitor-centered museum is that museums try to reach out to their prospective visitors [9].

The advantages and disadvantages of virtual museum includes: (Table 3) [10].

Table 1: Specialized museum techniques

Methods	Comments
Maceration of bone	Method by which parts of skeleton are allowed to putrefy at a stable temperature in a container devoid of oxygen to acquire a spotless skeleton.
Mounting of calculi	Calculi are cut into two halves, with a fine fretsaw, or coping saw and the cut surfaces polished with sandpaper. These polished specimens are cemented halfway through a sheet of perspex which is then cemented into the box, ensuring minimal disturbances.
Mounting of transparent specimens	Technique is dependent upon replacement of the tissue fluid, by fluids of higher refractive index. Two most commonly used techniques are - Spalteholz technique and Dawson's technique.
Whole organ mounting	The entire organ may be sectioned and mounted on paper by methods of Gough and Wentworth
Injection techniques	Visualization of blood vessels, lymphatics, bronchi, bile ducts and other anatomical structures can be enhanced by injecting radiopaque colored insoluble substances. Materials routinely used includes polyester resins, neoprene latex, radiopaque materials and gelatin

Table 2: Advantages and Disadvantages of Plastination

Advantages	Disadvantages
Simple technique, inexpensive and produces maintenance free permanent specimens	Process is time consuming and technique sensitive
Prepares a real dry, odorless, durable and nontoxic specimen	Needs more equipment's than that for conventional laboratory methods
Plastination is a reversible and deplastination permits the use of tissue for routine histological, special stains and IHC procedures.	Post curing work is intense and troublesome
	Deplastination is not possible with all types of resins

Table 3: Advantages and Disadvantages of Virtual museums

Advantages	Disadvantages
Provides unlimited space for innumerable specimens and allows the display of fragile specimens	Development is time consuming and requires special expertise as well as high expenditure
It gives a more vivid and realistic experience as exhibits can be interactively observed from different viewpoints or can be even manipulated	It cannot be accessed by a laymen who is not aware of usage of electronic media
Provides a multisensory experience to the museum visitor	It fails in terms of tactile and emotional experience that is provided by wet cadavers
It can be accessed at any exhibition site or remote location	

Conclusion

Since each specimen is unique, there is a growing need for newer techniques for mounting and preserving specimens. Due to space constraints, dentistry display space must be used intelligently in the contemporary environment. Virtual museums are among the most wanted technologies because they bring museums into the current electronic world. In order to make his museum more user-friendly, visually appealing, and simpler, every histologist needs to keep an eye out for the newest and best technologies available [11].

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