



UNEARTHING THE SECRETS: AN IN-DEPTH GUIDE TO BONE PREPARATION TECHNIQUES

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Received 15th July 2024; Revised 20th Sept. 2024; Accepted 1st Nov. 2024; Available online 1st Nov. 2025

<https://doi.org/10.31032/IJBPAS/2025/14.11.9547>

ABSTRACT

Introduction - The painstaking process of bone preparation involves a number of procedures. Unfortunately, a large number of priceless human bone collections have been destroyed over the years due to the lack of a consistent technique, as various medical colleges have a tendency to overlook the post-dissection processing of cadaver bones. Over time, a variety of methods have been used to prepare bones for anatomical studies. Given this situation, the goal of the current investigation was to determine the most effective and quick way to prepare bones taken from embalmed and moist specimens.

Material and methodology -Therefore, a new method entails the following steps to prepare a presentable dry bone specimen for the museum and students: 1) abstract the bones from the cadavers; 2) remove the soft tissues; 3) scrapping with sand paper 4) bleach; 5) boil; 6) keep for dry; 7) paint with thinner; 8) use acrylic paint to mark the external features of the bones for the students' study; and 9) paint with thinner once more. In this process used acetone, potassium hydroxide, hydrogen peroxide, thinner and acrylic colours.

Result - It was noted that every bone was properly preserved and would be very beneficial to the students in helping them understand the external characteristics of bones.

Discussion and conclusion – this study came to the conclusion that the process used to prepare bones for anatomical examination was efficient, quick, odourless and yielded good quality human bones. While this technique advances the methods of specimen preparation, it also sheds light on the state of the nation's anatomy museum at the moment and the room for improvement.

Keywords: Preparation, Bones, Colour, Specimen, Anatomy, Museum

INTRODUCTION

As early as 1600BC in Egypt, the study of anatomy was being developed [1]. The surgeons of Edinburgh made the decision to gather anatomical specimens, artwork, and writings between 1699 to 1763, which is when the idea of anatomy museum first emerged. The collection of curiosities was the name given to it [2]. One of the oldest museums is thought to be the university of Bologna's Museum of human anatomy [3]. The majority of the early museum's collections consisted of paintings and models. This occurred as a result of the formalin preservative's delayed discovery until 1859. Formaldehyde was first found in 1859 by Mikhailovich Butlerov, and it was then isolated in 1868 by August Wilhelm von Hoffmann [4].

Anatomy has changed over time as a base for medical education. The problem of teaching anatomy has grown difficult. Osteology, or the study of bones, is a crucial and vital component of the curriculum for teaching anatomy [5]. The capacity to teach osteology in three dimensions using human bones is unmatched. Bones may also be used to understand where soft tissue will attach and how the local neurovascular bundles will travel. The most effective way to study the crucial facets of bone anatomy is by combining a dry bone with books, atlases, and anatomy dissection [6].

The main steps in bone preparation include the removal of soft tissues, bone whitening, bone articulation, and labelling. The length of the time needed for these procedures varies depending on the size of the human or animal corpse, respectively [7]. Soft tissue from bones is also removed using chemical solutions of both organic and inorganic substances. Anti-formin, ammonium hydroxide, sodium hydroxide, potassium hydroxide, and other alkaline solutions are examples of inorganic compounds employed [8].

Due to the government's policy of not granting any merchant a license to trade in human bones, authentic human bones are not readily accessible on the market. Although most medical institutions do not handle the bones following the dissection of human cadavers, a sizable repository of human bones is lost in the absence of a defined procedure of bone retrieval. Genuine human bones are unreasonably pricey when sold by unlicensed individuals, and that's on top of not having a legitimate invoice. The morphological details of commercially available artificial bones made of plaster of Paris or resins are subpar compared to those of real bones [9].

After experimenting with various techniques, the authors have been able to standardize their own approach and present the technique for removing bones from

cadavers using a combination of different bone cleaning techniques, preserve and colour them for anatomical studies.

MATERIALS

1. Bone
2. Bucket with water
3. Sand paper
4. Sun light
5. Hydrogen peroxide
6. Potassium hydroxide
7. Calcium hypochlorite (bleaching powder)
8. Thinner
9. Cotton cloth
10. Dryer
11. Acrylic colour
12. Painting brush

METHODOLOGY

The following procedure are used to prepare and preserve bones those abstract from cadaver:

- In the first place, bones are removed from a female cadaver during PG dissection classes at Parul University in Vadodara, Gujarat.
- After that, using a scalpel and forceps, clean all the bones and remove the muscles and fatty tissues from them.
- The tissue is still present after removal by scalpel at the upper and lower ends of long bones as well as

on the asymmetrical surface of irregular bones.

- Even if the tissue on the surface of the bone has not been sufficiently abstracted with a scalpel and forceps, prepare a potassium hydroxide solution to loosen it.
- To make a potassium hydroxide solution, fill a bucket halfway with water, add 250g of potassium hydroxide, and then immerse all of the bones in it.
- To achieve the best results, soak the bone in solution for 2-4 hours.
- So, use the sandpaper to scrape away any remaining tissue from the bone's surfaces, nooks and crannies after soak in solution.
- Prepare a calcium hypochlorite paste to achieve a tissue-free bony surface because after these procedures, the tissues will still be attached to the bone's surface.
- The paste should be evenly distributed over the bones' surfaces and nooks and crannies.
- After completing this procedure, the bones should be left in the dissection room for two days to allow the calcium hypochlorite paste to dry on them.
- The bones were covered with calcium hypochlorite paste after they

had dried well as particles of paste were shade off, a vessel with water and hydrogen peroxide solution was kept on fire to begin the boiling process.

- Boil the bones in vessel for 3–4 hours on a static flame.
- After the bones have finished boiling, remove them from the container and wipe them with a dry cotton cloth and a hair dryer.
- Even after performing all of these cleaning techniques, some tiny tissue fragments and paste materials of calcium hypochlorite will still be present on the bones.
- To take out those fragments, scrape again the bones properly with the help of sandpaper.
- Finally found healthy, clean bones as a result of this technique. The bones are then set on the rooftop of the college under the supervision of dissection hall workers, to keep moisture and hydration away.
- There are always those watching eyes to keep birds and insects away from the bones while they are drying on a rooftop.
- Sand and acetone can be used to dry bones. There are alternative drying methods, however using sunshine is the most economical one.

- After finishing the bone preparation process, use painting brushes to apply acrylic colour to the bone's exterior characteristics, such as its borders, surface, muscle attachment (both origin and insertion), condyles, and tubercles etc.
- Apply the varnish or thinner after finishing the bone's colouring procedure. The procedure enhanced the bones' shine and provided fungal protection.
- And keep them for dry for 2-3 days after applying thinner or varnish.

RESULTS

The dry bone specimens were manufactured over a year ago and have all the necessary markings with acrylic colour. Even now, a year after they were used, there is no sign of any fungus or microbes, and no any kind of oily substance found on their surface.

DISCUSSION

The teaching of anatomy includes osteology, or the study of bones, as a vital and integral component for a better understanding of anatomy. Both teaching anatomy and evaluating the effectiveness of orthopaedic devices use dry human bones as important teaching tools. Soft tissue can decompose by a number of different processes, such as boiling, chemical usage, insect use, water breakdown, and burial in soil. Except for boiling, all of these techniques result in the

entire skeletonization of medium-sized and big animals [5]. which, depending on the quantity of bacteria present, the size of the object being macerated, and the temperature of the atmosphere during the maceration, take anything from two days to eight weeks. Moreover, skeletal material is cleaned mechanically after being boiled [10]. The main steps in bone processing include the elimination of soft tissue structures, bone whitening and marking. Depending upon the dimensions of the human body, these procedures take different amounts of time [7]. Soft tissue from bones is also removed using chemical solutions of both organic and inorganic substances. Antiformin, ammonium hydroxide, sodium hydroxide, and other alkaline solutions are utilized as inorganic compounds. Maceration with organic compounds can be accomplished by using enzymes like papain or pepsin, or washing powders that include enzymes [8] and use burying in soil also [5].

Maceration - To study the effects of altering freshwater pH on bone, bones were macerated in solutions with different pH levels. Collagen and cartilage were further broken down by boiling in borax, and any remaining lipids were then removed by soaking in xylol. High pH values have the potential to be harmful, although intermediate pH values have more subtle but nevertheless serious repercussions. The bone is not significantly impacted by the pH

7 or pH 10 solutions, but it is to a different extent by the other solutions [11]. Although maceration techniques remove soft tissue by destroying biomolecules, they may also have an impact on the morphology and molecular integrity of the hard tissue [8].

Types of maceration –

1. Using insects
2. Use of chemicals – include two another method
 - Detergent maceration
 - Enzyme maceration

Crucial elements

- The technique makes use of substances that are easily accessible from any vendor dealing in chemicals or from any medical college's anatomy department.
- The procedure only requires a small amount of chemicals.
- This technique can be used on formalin-fixed cadavers because it avoids using insects to clean the bones because they don't eat into formalin-fixed tissue.
- The technique preserves all of the bone's morphological characteristics without causing any damage to the bones.
- Due to the marking with acrylic colour, this method is very helpful for students to recognize and

properly learn about external features and muscle attachments.

CONCLUSION

We conclude that the abstraction and preparation of bones are very easy and cost effective by using this method. This method produces bones that are of extremely high quality in terms of morphological details and can be used for anthropological and morphometric studies.

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