



COVID & the Curriculum: Faculty Perspectives

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The Use of Plastinated Prosections to Teach Anatomy in the Time of COVID-19

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The shift in 2004 from cadaveric dissection to the use of plastinated anatomical prosections at NYU Dentistry was made with the knowledge that an extensive, though limited, collection of plastinated teaching specimens would be handled by hundreds of students every year. This was followed by curricular changes that called for small, consistent groups, frequent administration of low impact quizzes, and the addition of computers to guide self-directed study.

In terms of retention of anatomy and student satisfaction, we attribute the success of the Head & Neck Anatomy course to the plastinated Anatomical Teaching Collection and to principles of small group independent learning. We found that this format of teaching head-and-neck anatomy proved highly adaptable to the demands of remote learning during the COVID pandemic. This essay discusses the curricular adaptations to remote learning for Head & Neck Anatomy and personal observations regarding the impact those changes had on anatomy education and student satisfaction.

Before COVID

Before the pandemic, students attended anatomy lectures at Septodont Hall – NYU Dentistry's largest facility for student lectures – before encountering each anatomical subject scheduled for lab that week or the following week. Before lab, students took a pre-lab anatomy quiz online, which was available to them beginning two days before lab and closed for access once their scheduled lab session began. While all lectures at the College were ultimately presented via Zoom during the pandemic, nothing needed to change in terms of our pre-lab anatomy quizzes. Before the pandemic, after taking the pre-lab online quiz, students attended in-person anatomy labs where they interacted with the plastinated prosections from our Anatomical Teaching Collection. Once in lab, students organized into small groups of three to four students. Each group occupied one of four tables where they would interact with plastinated prosections, sheet plastinates, and various osteological objects. As a group, students examined the three-dimensionality of the body and specific anatomical regions of the head and neck. Anatomy labs ran for 110 minutes. During the final ten minutes of lab, there was a post-lab exit quiz administered by an instructor on PowerPoint and projected behind a lectern.

We found that the physical interaction with plastinated prosections during lab – in conjunction with other constituent parts of the course – contributed substantially to student satisfaction, higher overall scores in the Anatomic Sciences on the National Board Dental Examination (NBDE) Part I since 2004, and an average anatomy score of 1.73 standard deviations above the national mean over the last five years. Our plastinated prosections exhibit a high degree of anatomical specificity and are handled by approximately 380 new students and 13 core and adjunct faculty members each year. Periodic repair and restoration of the collection indefinitely extends the shelf life and educational utility of our prosections for future generations of NYU dental students. Thus, to retain those aspects of the course that we associate with its success (i.e., the plastinated prosections, small group learning, and frequent, low impact testing), the utilization of our Anatomical Teaching Collection demanded the most attention in terms of adapting our curriculum to remote learning.

During COVID

In addition to the requirement that lectures be given on Zoom, we digitally reconstructed our anatomy labs to approximate an experience as close as possible to in-person learning. Achieving this required a detailed photographic library of the Anatomical Teaching Collection comprehensive enough in scope to cover the whole breadth of the regional anatomy taught during in-person labs. We integrated labeled images of 2D and 3D specimens for all anatomical regions of the head and neck and body into digital "labs" formatted as PowerPoint presentations. Students were able to download them as PDFs from the online "NYU Classes" before attending their scheduled "labs" on Zoom, each of which was hosted by one to two faculty members. In keeping with precedent established before COVID, students were divided into the same groups for each lab. Students would access the links to their respective Zoom meetings in a folder located online in "NYU Classes."

The user features of Zoom (i.e., breakout rooms) allowed faculty to divide classes into small groups following a short introduction to each digital lab topic. These "breakout rooms" facilitated independent, small group learning by having students identify anatomical structures and answer related questions. Taken together, the exercises were designed to test students' ability to recall lecture content, identify structures and topography, and make anatomical and clinical sense of the relationships among the different elements.

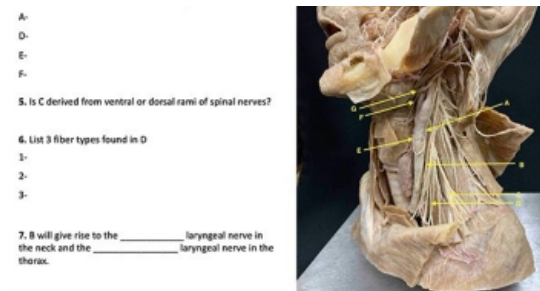
The scope of the anatomical detail of the head and neck makes visibility of structures and bony openings challenging for students even when viewed in person. Thus, it was crucial to obtain professional grade images with high resolution and lighting of specific regions of the plastinated prosections. Our department purchased a large, 27" Port-a-Cube LED Light Tent with Dimmer (II) from Angler. This portable light box served as a miniature "studio space" large enough to arrange and position prosected cadaver parts such as mounted head and necks, skulls, brains, spinal cords, arms, and thoracic and abdominal viscera. High resolution images were taken of all relevant anatomical regions of the prosections in three anatomical planes – transverse, sagittal, and coronal – at a distance and up close. These were then tightly cropped. Special attention was given to content heavy, intricate regions such as the orbit, deep neck, pterygopalatine fossa, and infratemporal fossa (Figure 1).

FIGURE 1. Infratemporal fossa



FIGURE 2. Deep neck





Digital labs ran 110 minutes, the same length of time as in-person labs and were structured as follows: I) Introduction-5 min., II) Breakout I-35 min., III) Reconvene I-10 min., IV) Breakout II-35 min., V) Reconvene II-15 min., VI) Exit Quiz-10 min. The first five minutes were used to introduce the anatomy topic of the day and expectations for the lab. For each Breakout session (I and II), students were subdivided into four breakout rooms, each comprised of three to four students to support a small group learning environment similar to the in-person lab. During breakout sessions, one student would share their screen of the lab PDF, and the other students would go through a list of relevant structures to identify on anatomical illustrations and on high resolution anatomical images, answering questions about the relationships with other structures, as well as their clinical significance (**Figure 2**).

The student sharing their screen could mark up the PDF, and other students could use Zoom annotation tools to indicate structures and write notes. Instructors were free to migrate from one breakout room to another, teaching and assisting students with the exercises. After each breakout session, an instructor collapsed the breakout rooms to allow all students and faculty to "reconvene" as a class to discuss and answer questions about the content. Both instructor and students were able to share their screens of the lab PDF during reconvene sessions and use Zoom annotation tools. During the remaining ten minutes of lab, students were dismissed from the Zoom meeting to take a digital exit quiz.

Discussion

We found that the Zoom format with breakout rooms provided a very focused environment with perhaps less distraction than with in-person lab. This was enhanced by the very targeted nature of the digital labs and structured exercises, as these made it very clear to students what their goals were for a given lab session. The small breakout groups allowed for ample opportunities for peer teaching and learning. The reconvene sessions afforded instructors the flexibility to teach in a way that was comfortable for them. It was a particularly good time to encourage students to present and "teach," facilitated by the ability to share one's screen on Zoom.

In addition to 3D cadaveric prosections, our collection also includes hundreds of sheet plastinates. Sheet

plastinates are 1-5mm thick, anatomical slices taken through all three anatomical planes of the head, neck, thorax, abdomen, and pelvis (**Figure 3**). These sheet plastinates demonstrate [often colored] anatomical structures in relation to one another in cross section and are translucent or completely transparent. They are an integral part of our pedagogical method of anatomy education (**Figure 4**) as they are comparable to images in radiography, computer tomography (CT), and MRI (**Figure 5**). Years ago, many of our sheet plastinates were scanned to be used as labeled images for students for future use.

FIGURE 3. Parasagittal slice of the head and neck



FIGURE 4. Orbit and eye

1. Identify the following:

A-
B-
C-
D-
E-

2. The muscle that controls the shape of B receives postganglionic fibers from the nerves whose cell bodies are contained within the _____.

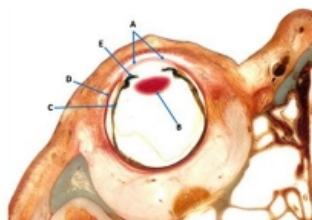


FIGURE 5. Coronal computed tomography showing sphenoid bone and middle cranial fossa

1. What is C?
What nerve passes through this opening?
2. What is H?
Does the temporalis fascia attach here?
3. What muscle has an attachment to H?

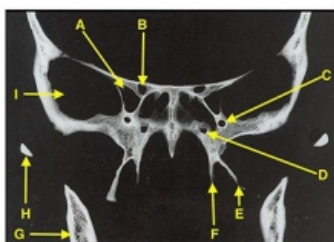


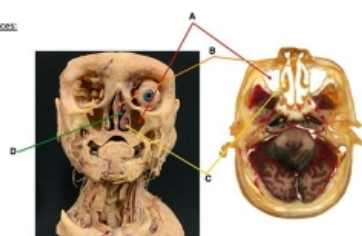
FIGURE 6. Nasal cavity and paranasal sinuses

1. Identify the following structures/spaces:

A-
B-
C-
D-

2. Structure C articulates laterally with which other bones (list at least 2)?

3. Which space in the nasal cavity will space A drain into?



Until COVID, only some of these sheet plastinates were used for cross sectional exercises and/or exit quizzes.

As might be expected, the large number of files of pre-scanned images of the sheet plastinates were extremely useful in helping us construct digital labs that were worthy of a first-rate anatomy education in a remote setting. When juxtaposed with images of 3D cadaveric prosections in a PowerPoint, the sheet plastinates provided a valuable means to clearly reveal – and make sense of – relationships of structures that might otherwise be less discernable in isolation (**Figure 6**).

The design of the lab documents was pivotal. Because they were carefully organized and were very clear (with questions, fill in the blanks, ID, etc.) there was no confusion as to what the students needed to learn. Also, the progression in the lab documents to promote more learning in the first breakout session and more recall during the second, meant that the students were led to practice what they learned within the same lab. The exit quizzes then reinforced that learning.

After the initial setup of the course, which was complicated due to class size, multiple groups and multiple faculty, the course was quite manageable. While the transition to remote learning took a lot of advance planning, with help and input from various faculty and from NYU Dentistry educational technologist, Lillian Moran, the pedagogical design of our course ultimately proved well suited to adapt to remote learning in the time of COVID.

CITATIONS

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