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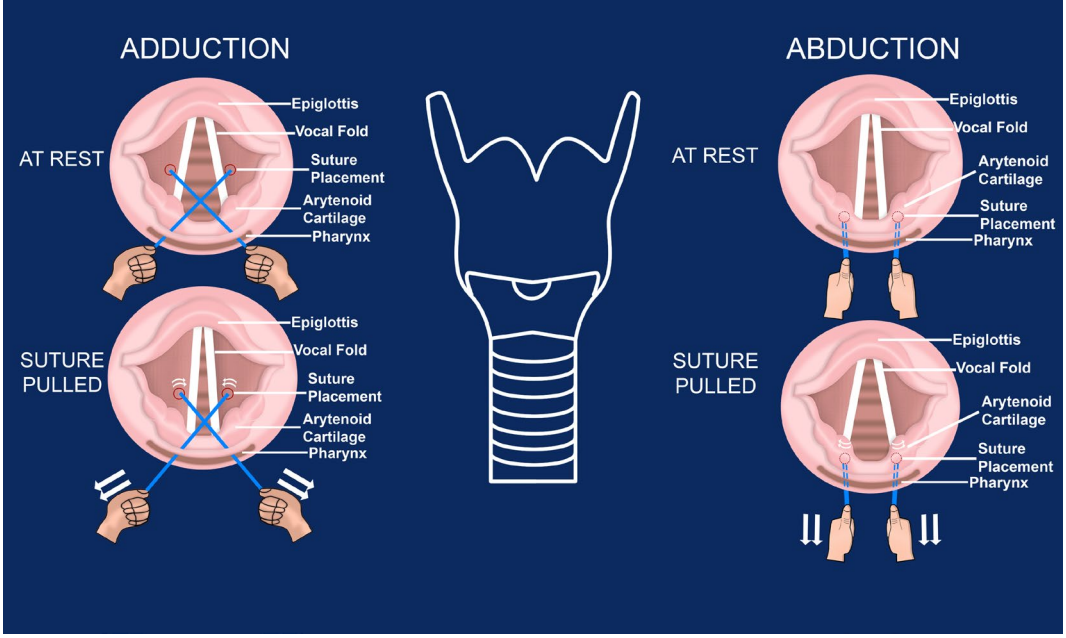
Published in:
Clinical Teacher

DOI:
10.1111/tct.13166

Publication date:
2020

Insights



Creating a dynamic cadaveric laryngeal model

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Laryngeal anatomy is a complex and challenging topic that students can find difficult during their Ear, Nose and Throat (ENT) teaching block. However, current time constraints in medical curricula have reduced the opportunities to provide in-depth anatomical teaching.[1] Ferguson et al.[2] conducted a systematic review revealing that medical students and junior doctors felt unprepared when commencing an ENT clinical post, with teaching methods used in undergraduate education being cited as one of the causes. It was suggested that greater attention should be given to pedagogical methods used in ENT teaching. Constable et al.[3] described similar findings, with students perceiving their ENT knowledge as substandard. The study proposed further interactivity in teaching methods used for undergraduate ENT education as study participants felt that traditional didactic approaches were ineffective.

The first author (MOA), a medical student, aimed to create a dynamic prosection that could permit learners to visualise laryngeal anatomy and to simulate vocal fold movement (Figure 1). To our knowledge, current dissection manuals do not provide guidance on the manipulation of the vocal folds to simulate glottic function in real life. We propose a procedure of creating a dynamic laryngeal prosection that allows users to simulate vocal fold movement in order to understand function. The Centre for Anatomy and Human Identification at the University of Dundee uses the Thiel embalming method to preserve cadavers for teaching and research. Thiel embalming is a soft-fix technique that is highly acclaimed for its preservation properties. Present literature advocates the use of Thiel-embalmed cadavers for teaching, because of their authentic representation of real-life anatomy, high flexibility, colour preservation and suitability for teaching surgical trainees.[4] The successful production of the dynamic cadaveric model was bolstered by these attributes of Thiel-embalmed cadavers.

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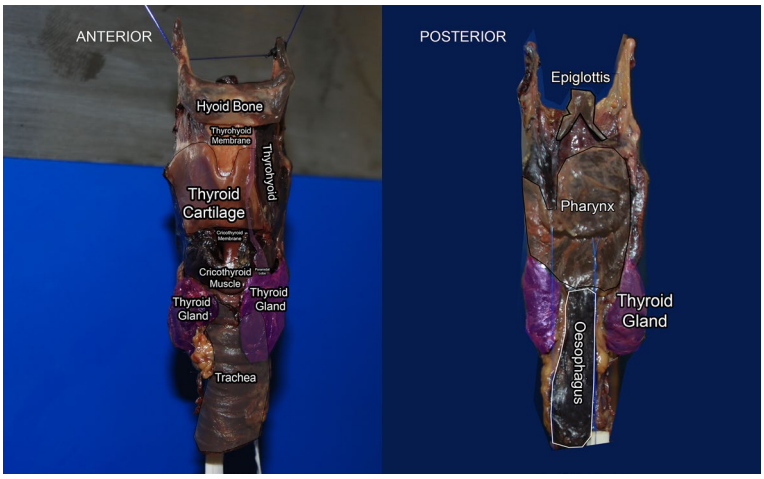

Figure 1. The model displaying the thyroid gland, hypopharynx and laryngeal muscles.

When planning the model, MOA shadowed an ENT consultant (SM) in the operating theatre and laryngology clinics to receive guidance on functional anatomy and surgical approaches to the larynx. The dissection was supervised by an anatomist (LR), who assisted with suture placement and the development of the model as a teaching resource. The process of model creation required a superficial to deep dissection of the neck (Figure 2), with photographs being taken for the development of future teaching resources. Excision of the larynx was achieved by horizontal incisions superior to the hyoid bone and inferior to the second tracheal cartilage, followed by the transection of surrounding neurovasculature (Figure 1). To simulate adduction of the vocal folds, 2.0 Monocryl suture was pierced through the mucosa of the left vocal fold at its junction with the vocal process and secured with a series of knots (Figure 3a). The remaining part of the suture was pierced through the pharynx on the contralateral side at a 70° angle (Figure 3b), allowing the user to pull the external suture and to generate torque at the cricoarytenoid joint. Thus mimicking the action of the lateral cricoarytenoid and transverse arytenoid muscles, resulting in vocal fold adduction (Figure 3c and d).

To simulate abduction of the vocal folds, a suture was secured through the mucosa close to the left muscular process of the arytenoid cartilage in order to achieve a counter force to the adducted vocal fold (Figure 4a). The remainder of the suture was pierced through the ipsilateral pharyngeal wall at a 170° angle. When pulled, the action of the posterior cricoarytenoid muscles was replicated, simulating vocal fold abduction (Figure 4b and c). The identical steps were repeated for the right vocal fold and the remaining external suture material was covered in protective paper and labelled to notify users of their action.

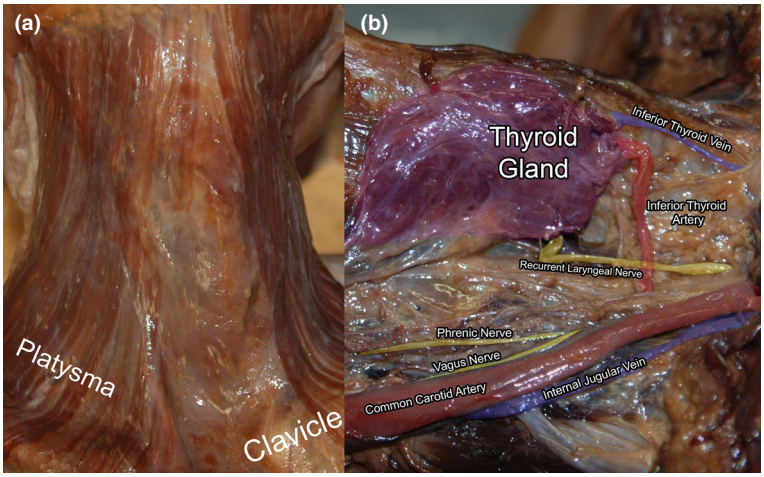

Figure 2. Images taken during the initial superficial to deep dissection: (a) superficial view of platysma muscles; (b) deep view of laryngeal neurovasculature in close approximation with the thyroid gland.

This project was undertaken to produce a prototype of a dynamic laryngeal prosection and to create a dissection protocol to aid its future reproduction. Interaction with the final product creates a new learning experience and enables the visualisation of glottic movement in 'real' anatomy facilitated by the Thiel embalming method. We feel that the student learning experience would be enhanced by developing the model for themselves and solving problems along the way, rather than solely handling the prosection. An advantage of this approach is that it employs elements of Kolb's experiential learning cycle, as students are given the opportunity to reflect and experiment towards achieving a goal.[5] We feel that the opportunity to gain skills in manual dexterity, problem solving and experimentation, while re-enforcing the understanding of anatomical concepts, provides a well-rounded learning experience for undergraduate medical students. Educators should be encouraged to find innovative ways to engage their students in deep learning, especially in the basic sciences, either in the core curriculum or in special study modules. This model successfully illustrated glottic movement and provides an example of a way to engage

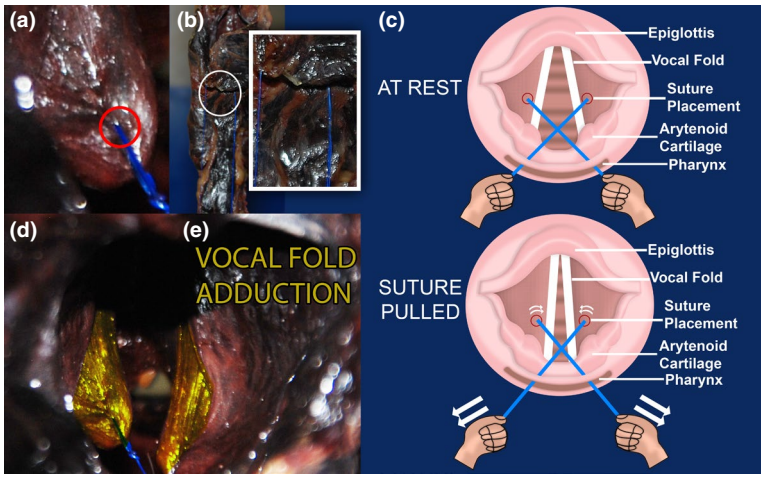

Figure 3. Images indicating suture placement for the simulation of vocal fold adduction: (a) location of knot placement on the vocal fold; (b) suture exiting via posterior pharyngeal wall; (c) dynamics of suture pull; (d) vocal fold adduction after pulling the suture.

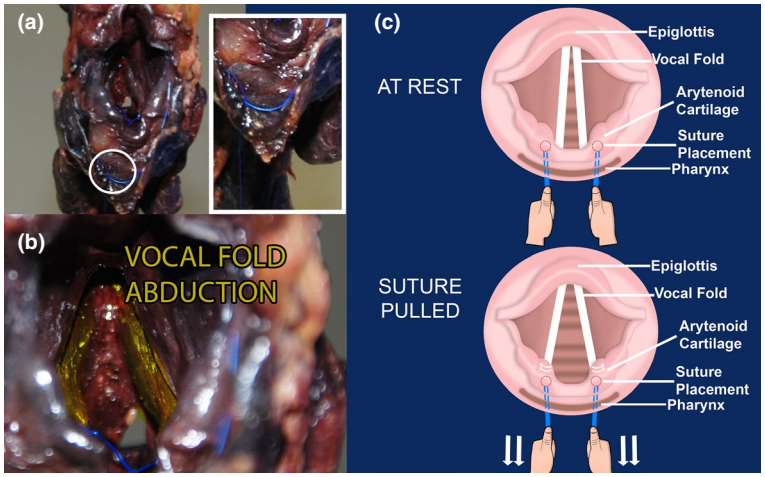

Figure 4. Images indicating suture placement for the simulation of vocal fold abduction: (a) knot placement in the mucosa near the left arytenoid cartilage; (b) abduction of vocal folds after pulling the suture; (c) dynamics of pulling the suture.

students in active learning. The second phase of this project will include collecting feedback from students and educators ascertaining the suitability of the model in undergraduate teaching.

Educators should be encouraged to find innovative ways to engage their students in deep learning …

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Funding: N/A.

Conflict of interest: N/A.

Acknowledgements: None.

Ethical approval: This project was approved by the Centre for Anatomy and Human Identification at the University of Dundee.

doi: 10.1111/tct.13166