NEW INSIGHTS INTO THE ANATOMICAL BASIS OF HUMAN CLEFT PALATE SURGERY

Szilvia Mezey 1, Daphne Schöneck 1,2, Benito K. Benitez 1,2, Mireille Toranelli 1, Syed Altaf Hussain 1, Magdalena Müller-Gerbl 1, Andreas A. Mueller 1,2

1 University of Basel, Dept. of Biomedicine; 2 University of Basel, Facial & Cranial Anomalies Research Group; 3 University Hospital Basel; 4 The Cleft and Craniofacial Center, Sree Balaji Medical College, Chennai, India

HIGHLIGHTS
- Microanatomy of the soft palate in relation to the surrounding bony structures.
- Extending cadaveric dissection with histological analysis of slices of whole cadaveric heads.
- Analysis of the relationship between the tensor veli palatini muscle, the superior pharyngeal constrictor and the hamular region based on nanoCT images of a newborn head.

INTRODUCTION
The anatomy of the hard and soft palate is generally accepted to be fully described and not to offer much more to be explored. However, the experience of maxillofacial surgeons during minimally invasive procedures for palatal cleft repair has raised the need for more detailed anatomical knowledge regarding the palate and its surroundings. Specifically, the microanatomical junction between the soft palatal aponeurosis and the tendon of the tensor veli palatini, as well as between the palatal aponeurosis and the perist of the medial pterygoid process, was examined and discussed in relation to soft palatal mobility.

MATERIALS & METHODS
- Traditional dissection of formaldehyde-fixed adult human heads.
- Methyleneblue (MMA) embedding: MMA-embedded sections were ground to a thickness of 250 µm and a combination of toluidine blue eopy and Masson-Goldner trichrome staining was applied.
- Nanotom® (phoenix|x-ray, GE Sensing & Inspection Technologies GmbH, Wunstorf, Germany) was used to image the plastinated head of a newborn human. Pixel size: 45-50 µm.

RESULTS
Tensor veli palatini (TVP)
Our results support the description by Rüdinger (1870) (revisited by Abe, 2004), that the tensor veli palatini muscle can be anatomically and functionally divided up into a lateral and medial head. The lateral head is attached to the outer cranial base and its tendon swings lateromedially around the pterygoid hamulus to radiate into the superior-anterior layer of the aponeurosis in the soft palate. Accessory insertion of the lateral head reaches the maxillary tuberosity, as well as between the palatal aponeurosis and the perist of the medial pterygoid process, was examined and discussed in relation to soft palatal mobility.

Superior pharyngeal constrictor (SPHC)
Our methods, both in adult and newborn, reinforce the findings of Whillis (1930) and Sumida et al. (2017) based on traditional dissection. The superior pharyngeal constrictor (SPHC) inserts along the posterior edge of the medial pterygoid plate and continues beyond the hamulus along the pterygo-mandibular raphé. An additional fibre tract radiates from the superior border of the SPHC into the lateral palatal aponeurosis, corresponding to the palatopharyngeal sphincter lifting up Passavant’s ridge during velopharyngeal closure (Whillis, 1930; Sumida, 2017).

CONCLUSIONS
Minimal incision palatoplasty using the medial approach has several advantages:
1. It preserves the anatomical-functional unit of the palatal aponeurosis with the auditomy via the mTVP.
2. It maintains velopharyngeal function by keeping the attachment of the superior pharyngeal constrictor on the hamulus intact.
3. It helps to avoid growth-related disturbances resulting from scarring at the maxillary tuberosity, a known growth zone of the maxilla.

ACKNOWLEDGEMENTS & LITERATURE
- All images were created and used in accordance with the guidelines of the Swiss Federal Office of Public Health.

CLINICAL RELEVANCE
Based on the anatomical conditions, a purely intravelar, medial approach is possible in order to mobilize the palatine aponeurosis for soft palate closure in the midline. It is enough to release the lateral TVP tendon next to the pterygo-palatine suture, antero-medially of the hamulus. As a further advantage, the functional connection between the palatine aponeurosis and the superior pharyngeal constrictor can also be preserved.