Soft Palate Development in Mouse: a Comprehensive Study

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Objectives: Cleft palate is one of the most common birth defects, and over the last decades tremendous efforts have been made towards understanding hard palate development. However, little is known about soft palate muscle morphogenesis and tissue-tissue interactions guiding it. Appropriate surgical repair to restore physiological functions of the soft palate in patients with cleft palate is a current challenge for surgeons, and complete restoration is rarely achievable. First, our study focuses on describing the murine soft palate morphology, the orientations and attachments of all 4 muscles and comparing them with the human anatomy. Then we highlight the development of soft palate muscles in mice, in relation to the surrounding mesenchyme, tendons, nerves, and vasculature.

Methods: We performed dissections, histochemistry and immunohistochemistry on mouse embryos, newborns and adults and recreated a 3D model of the murine soft palate.

Results: First, we found that the morphology, orientation and attachment of the mouse soft palate is very similar to human, validating the use of the murine model for future studies. Then our data suggests that the Tensor Veli Palatini (TVP) and Palatoglossus (PLG), but not the Levator Veli Palatini (LVP) or Palatopharyngeus (PLP), express differentiation markers (Myosin Heavy Chain) before fusion of the palatal shelves. Moreover, the differentiation of the LVP and PLP occurs from the middle portions to the lateral portions, suggesting that a pool of undifferentiated myoblasts is required in the middle of the LVP and PLP during fusion. Innervation was detected in the oral side of the soft palate and in the TVP and PLG before fusion.

Conclusion: Taken together, our results give a comprehensive view of the development and morphology of the murine soft palate, setting the stage for further molecular analyses. We are currently investigating how cleft palate affects the formation of the soft palate muscles using different mutant mouse models.