



University of Pennsylvania Dental Medicine

**Single Cell Transcriptomics Identifies Mesenchymal Stem Cell  
Lineage Trajectories During Maxillary Expansion**

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THESIS

Presented to the Faculty of Penn Dental Medicine in Fulfillment of the  
Requirements for the Degree of Master of Science in Oral Biology

A handwritten signature in black ink, appearing to read "Chider Chen", written over a horizontal line.

Dr. Chider Chen, PhD

A handwritten signature in black ink, appearing to read "Chun-Hsi Chung", written over a horizontal line.

Dr. Chun-Hsi Chung DMD, MS

A handwritten signature in black ink, appearing to read "Normand Simon J. Boucher", written over a horizontal line.

Dr. Normand Simon J. Boucher, DDS

A handwritten signature in black ink, appearing to read "Hellen Teixeira", written over a horizontal line.

Dr. Hellen Teixeira, DDS, MS, DScD