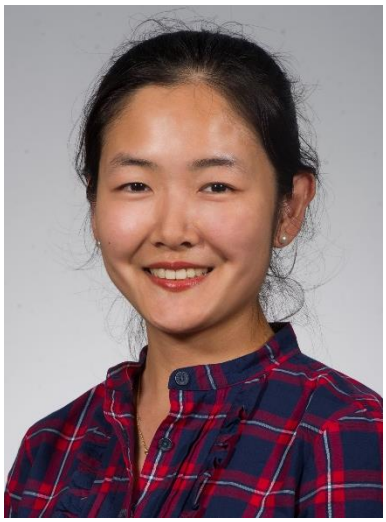
Biomedical Research Award

Dr. Yan Jing, *Texas A&M University*



I am a clinician-scientist who is well trained in both basic and clinical sciences directly linked to mandibular biology and orthodontics. My research focuses on the following three areas: 1) the roles of chondrocyte-derived bone cells in condylar development and

remodeling; 2) the novel roles of endochondrogenesis in mandible formation and trauma repair; and 3) the novel roles of tendon in TMJ condyle formation and remodeling.

Cell transdifferentiation from one type of mature cells to another occurs in many processes including gastrulation, neural crest and somite dissociation, craniofacial development, wound healing, organ fibrosis, and tumor metastasis. Our recent publications, in agreement with other studies, demonstrate direct transdifferentiation from chondrocytes to osteoblasts/osteocytes in the TMJ condyle ramus and long bone without going through the stem cell stage. These chondrocyte-derived bone cells (CBC) account for approximately 70-80% of endochondral bone.

To study the role of chondrocytes during maxillary bone growth and their response to altered loading, we carried out a series of in vivo experiments using comprehensive states-of-the-art techniques combined with cell lineage tracing approaches. Our key findings are that: 1) the activity of chondrocyte transdifferentiation is directly regulated by the alteration of mechanical loading in TMJ; 2) there are multiple layers of chondrocytes at the mid-palatal suture, with numerous chondrocyte-derived bone cells in the adjacent bone area of normal growing mice; and 3) decreased loading in craniofacial bone induced by soft diet dramatically reduces the chondrogenesis and chondrocyte-derived osteogenesis in mid-palatal suture, which further indicates a direct regulation of mechanical stimuli on chondrocyte transdifferentiation. Our central hypothesis, based on these findings, is that chondrocytes in mid-palatal suture directly participate in the growth of maxilla via a cell transdifferentiation mechanism, which is greatly accelerated in response to rapid palatal expansion.

Our study is significant because it will: 1) shed new light on the cellular and molecular mechanisms underlying maxillary bone growth and expansion during orthodontic/orthopedic treatment and 2) lay the foundation for developing novel approaches, which will ultimately accelerate maxillary expansion and enhance the treatment stability.

As a clinician scientist, I appreciate that the AAOF provides me a great opportunity and platform to continue my research study and broaden my knowledge in different areas. Of note, with the support of my last AAOF/BRA grant entitled Novel roles of chondrocyte-derived bone cells in mechanical strain-induced TMJ remodeling (2017-2018), I was able to generate pilot data with high novelty and successfully obtain a R03 from NIDCR in 2020.