

AAO Foundation Final Report**Type of Award:** Orthodontic Faculty Development Fellowship Award (OFDFA)**Name of Principal Investigator:** Jin Hee Kwak, D.D.S., M.S.**Title of Project:** Patient-oriented Craniofacial Research**Period of AAOF Support:** 7-1-17 to 6-30-18**Amount of Funding:** \$20,000**Summary/Abstract** (250 words):

The goal of this proposal is to provide the Proposed Fellow, Jin Hee Kwak, DDS, MS, with the opportunity to continue developing her academic career as a full-time faculty member in Section of Orthodontics at the UCLA School of Dentistry. Dr. Kwak is currently an associate professor and Clinic Director of the UCLA Section of Orthodontics. She holds a K08 Mentored Clinical Scientist Research Career Development Award from NIDCR (4/2017 – 3/2022). She plans to establish herself as a scientist in clinical orthodontics and translational research, as a mentor to dental students and orthodontic residents, and as a practicing orthodontist. The Orthodontic Faculty Development Fellowship Award from the American Association of Orthodontists Foundation provided a great support for her development in education and research. Dr. Kwak's primary mentor is Dr. Kang Ting, a well-established molecular bone biologist and the Chair of the Division of Growth and Development and the Section of Orthodontics at UCLA. In addition, she was co-mentored by Dr. Won Moon, the Program Director of the Postgraduate Orthodontics Program, Dr. Benjamin Wu, the Chair of the Division of Advanced Prosthodontics at the UCLA School of Dentistry and the UCLA Department of Bioengineering, and Dr. Chia Soo, the Vice Chair of Research at the UCLA School of Medicine. Dr. Kwak followed a structured plan of education, research, teaching, and clinical practice to enhance the abilities she will need to pursue her academic career in orthodontics.

Research Project Description:

The award proposal outlined Dr. Kwak's development plans in education, research, teaching, and clinical aspects. The specific aims of Dr. Kwak's research component for the funding period are as follows:

- (1) Investigate the effects and stability of mini-implant assisted rapid palatal expander (MARPE) based treatment and craniofacial deformity patient treatment.
- (2) Optimize the dosage and formulation of NELL-1 as a systemic therapy in mice.
- (3) Investigate the effects of an optimized systemic NELL-1 therapy in mice in space (study in collaboration with NASA-CASIS).

Response to the following questions:**1. Were the original, specific aims of the proposal realized?**

- (i) Educational component: As proposed, leadership meetings were attended as below:

- The 2018 Society of Educators (SOE) as part of the American Association of Orthodontists Annual Session in Washington DC, May 2018.
- Formed an advisory committee of renowned clinician scientists at UCLA and received a K08 award from NIDCR. Active meetings and formulation of a comprehensive career development plan were done.

(ii) Research component: Significant progress has been made for the three proposed research projects, resulting in **three** publications, **two** invited lectures at the AAO annual session 2018 and the Korean Association of Orthodontists (KAO) annual session 2017 in Gyeongju, South Korea, **one** abstract presentation, and several media coverages highlighting the spaceflight project in collaboration with NASA and CASIS. In addition, we have successfully completed the spaceflight project entitled the Rodent Research-5 (RR-5) in November 2017, and is currently in the process of data analysis. The goal of the mission was to examine the effect of optimized systemic rNELL-1 therapy for the reversal of osteoporosis induced by both menopause (via ovariectomy mouse model) and disuse atrophy and aging (via spaceflight model). This mission signifies America's first live-return of animals, Man's first live-return of drug-treated animals, and World's first use of post-flight recovery model to continue testing the therapy on Earth. All animals returned alive, healthy and happy (eating, pooping and grooming) after 5 weeks of spaceflight and survived through the entirety of the experiment including the recovery phase of 4 weeks on Earth. This ensured high quality data and reliability of the experiment. We anticipate to have significant findings in at least 7 organ systems, including bone, cartilage, muscle, craniofacial, neural, fat and gastrointestinal tract (microbiome), and serve as foundation for future grants, papers and more exciting projects.

(iii) Teaching component: As proposed, I chaired and taught the following postgraduate orthodontic academic courses:

Clinical courses:

- Introduction to Orthodontics (DS492)
- Orthodontic Retainer Course (DS308.08)
- Typodont Course (DS307.11)
- Post-doctoral Orthodontic Clinic (DS308/07.03)- weekly clinic supervision.
- Pre-doctoral Orthodontics Techniques and Clinical Block Rotation (CL403.08/CL404.08)

Didactic course:

- Craniofacial growth and development- Biological Basis (DS300.03)

(iv) Clinical component: As proposed, I taught and prepared residents to complete the ABO certification process at the end of their residency program. All **seven** residents graduating this year are expected to take the ABO Clinical Exam within the next year. I

also taught and supervised patient care in the post-doctoral orthodontic clinic throughout the year and continued to practice orthodontics at the UCLA Faculty Group Dental Practice 1.5 days a week.

2. Publications (**All acknowledged the current AAOF support*):

Kwak, J.H. and Chen, E. An Overview of the American Board of Orthodontics Certification Process. *APOS Trends Orthod* 2018;8:14-20. DOI: 10.4103/apos.apos_2_18.

Tanjaya J., Lord E.L., Wang C., Zhang Y., Kim J.K., Nguyen A., Baik L., Pan H.C., Chen E., Kwak J.H., Zhang X., Wu B., Soo C., Ting K. The Effects of Systemic Therapy of PEGylated NELL-1 on Fracture Healing in Mice. *Am J Pathol.* 2017 Dec 30. pii: S0002-9440(17)30883-0. doi: 10.1016/j.ajpath.2017.11.018. [Epub ahead of print]. PMID: 29294300.

Pan, H.C., Lee, S., Ting, K., Shen, J., Wang, C., Nguyen, A., Berthiaume, E.A., Zara, J.N., Turner, A.S., Seim, H.B. 3rd, Kwak, J.H., Zhang, X., Soo, C. Cyst-like Osteolytic Formations in Recombinant Human Bone Morphogenetic Protein-2 (rhBMP-2) Augmented Sheep Spinal Fusion. *Am J Pathol.* 2017 Jul;187(7):1485-1495. doi: 10.1016/j.ajpath.2017.03.010. Epub 2017 May 11. PMID: 28502475.

3. Presentations (**All acknowledged the current AAOF support*):

Podium presentations:

Ting, K & Kwak, J.H. "Taking Craniofacial Patient Discoveries to the International Space Station". Invited lecture. American Association of Orthodontists Annual Session, May 2018, Washing DC, USA.

Kwak, J.H.* "From the Craniofacial Clinic to Outer Space". Invited lecture. Korean Association of Orthodontists Annual Session, Nov 2017, Gyeongju, South Korea.

Zhang, Y., Shi, J., Kwak, J., Tanjaya, J., Yu, M., Ha, P., Wang, C., Pan, D., Chen, E., Zhang, X., Soo, C., Wu, B., Ting, K. "A New Bone Seeking Anabolic Protein, Bisphosphonate-Modified NELL-PEG, Can Effectively Reverse Osteoporosis by Systemic Administration". American Society for Bone and Mineral Research Annual Meeting, Colorado, Sept 2017.

4. To what extent have you used, or how do you intend to use, AAOF funding to further your career?

I have used the AAOF OFDFA funding entirely for salary support. This has partially provided me with financial stability, and thus allowed me more time to focus on the proposed career development goals in education, research, teaching, and clinical components.