

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:** 7-1-15 to 6-30-16**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 currently serves as the Clinic Director of the Postgraduate Orthodontics Program at UCLA. 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 will greatly support her development in education and research. Dr. Kwak's primary mentor will be 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 will be 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 will follow a well-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 outlines her 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 2016 Society of Educators (SOE) - Thomas J. Cangialosi Educational

Leadership Conference. Orlando Florida, April 2016.

- The Charles Burstone – American Board of Orthodontics 2016 Educator’s Symposium, St. Louis, April 2016.

(ii) Research component: Significant progress has been made for the three proposed research projects, resulting in **six** publications and one additional in preparation, **seven** oral presentations, and **three** poster presentations (see lists below).

(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.

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 present all six cases to ABO within the next year. I also taught and supervised patient care in the post-doctoral orthodontic clinic throughout the year. I also continued to practice orthodontics at the UCLA Faculty Group Dental Practice once a week.

2. Publications:

Tanjaya, J., Zhang, Y., Lee, S., Shi, J., Chen, E., Ang, P., Zhang, X., Tetradis, S., Ting, K., Wu, B., Soo, C., **Kwak, J.H. (Corresponding and co-senior author)**. Efficacy of Intraperitoneal Administration of PEGylated NELL-1 for Bone Formation. *BioResearch* open access. 2016; 5(1):159-170.

** AAOF support acknowledged*

Shi, J., Lee, S., Uyeda, M., Tanjaya, J., Kim, J.K., Pan, H.C., Reese, P., Stodieck, L., Lin, A., Ting, K., **Kwak, J.H. (Co-senior author)** & Soo, C. Guidelines for Dual Energy X-ray Absorptiometry Analysis of Trabecular Bone-rich Regions in Mice: Improved Precision, Accuracy and Sensitivity for Assessing Longitudinal Bone Changes. *Tissue Eng Part C Methods*. 2016 Mar 9. PMID: 26956416. ** Front cover feature article.*

** AAOF support acknowledged*

Guo, M., James, A.W., **Kwak, J.H.**, Shen, J., Yokoyama, K.K., Ting, K., Soo, C., Chiu, R.H.

Cyclophilin A (CypA) plays dual roles in regulation of bone anabolism and resorption. *Scientific Reports*, 2016 Mar 2;6:22378. doi: 10.1038/srep22378.

* *AAOF support acknowledged*

Papour, A., **Kwak, J.H.**, Taylor, Z., Wu, B., Stafsudd, O., Grundfest, W. Wide-field Raman imaging for bone detection in tissue. *Biomed Opt Express*. 2015 Sep 10;6(10):3892-7. doi: 10.1364/BOE.6.003892.

James, A.W., Shen, J., Zhang, X., Asatrian, G., Goyal, R., **Kwak, J.H.**, Jiang, L., Bengs, B., Culiati, C.T., Turner, S., Seim III, H.B., Wu, B.M., Lyongs, K., Adams, J.S., Ting, K., Soo, C. NELL-1 in the Treatment of Osteoporotic Bone Loss. *Nature Communications*. 2015 Jun 17;6:7362. doi: 10.1038/ncomms8362.

Kwak, J.H., Zhang, Y., Park, J.Y., Chen, E., Shen, J., Chawan, C., Tanjaya, J., Lee, S., Zhang, X., Wu, B., Ting, K., Soo, C. Pharmacokinetics and Osteogenic Potential of PEGylated NELL-1 In Vivo After Systemic Administration. *Biomaterials*. 2015 Jul;57:73-83. doi: 10.1016/j.biomaterials.2015.03.063. Epub 2015 Apr 24.

Khalilinejad, K., Chen, E., Choi, H.W., Lin, Y., **Kwak, J.H. (Co-senior author)**, Moon, W. Dentoskeletal effects of Maxillary Skeletal Expander (MSE), a type of Micro-implant assisted Rapid Palatal Expander (MARPE), in adolescents and adults. *In preparation*.

3. Presentations

(i) Oral presentations and awards (AAOF award acknowledged in all):

Kwak, J.*, Shi, J., Pan, H.C., Chen, E., Zhang, Y., Lee, S., Ting, K., Wu, B., Soo, C. "Systemic NELL-PEG Therapy: Skeletal effects on the ground and in space". Consortium for Orthodontic Advances in Science and Technology (COAST) - Workshop on "Personalized & Precision Orthodontics". September 2016, West Palm Beach, FL. * *Invited for podium presentation*.

Kwak, J.*, Shi, J., Lee, S., Chen, E., Zhang, Y., Pan, H.C., Stodieck, L., Ting, K., Wu, B., Soo, C. "Novel systemic PEGylated NELL-1 therapy for osteoporosis in space". International Space Station (ISS) R&D Conference, July 2016, San Diego, CA. * *Accepted for podium presentation*.

Uyeda, M., Shi, J., Lee, S., Zhang, Y.*, Chen, E., Lim, R., Ting, K., Wu, B., **Kwak, J.H.**, Soo, C. "Systemic NELL-1 Administration Regenerates Bone in Osteoporotic Mice". Plastic Surgery Research Council (PSRC), May 2016, New York.

Tanjaya, J.*, Zhang, Y., Lee, S., Shi, J., Dousti, M., Ang, P., **Kwak, J.H.**, Ting, K. Efficacy of Intraperitoneal Administration of Pegylated NELL-1 for Bone Remodeling. American Association for Dental Research (AADR), March 2016, Los Angeles, CA. * *Selected as finalist for Johnson & Johnson Hatton Awards Competition*.

Frumpp, D.*, Shi, J., Uyeda, M., Pan, H.C., Kim, J.K., **Kwak, J.H. (Senior author)**. Altered

skeletal morphology resulting from in vivo micro-CT radiation exposure. American Association for Dental Research (AADR), March 2016, Los Angeles, CA.

Lim, R. *, Shi, J., Kim, J.K., Pan, H.C., Reese, P., Chen, E., Zhang, Y., Lee, S., Wu, B., **Kwak, J.H.** (Senior author). Systemic NELL-1 Administration Regenerates Bone in Osteoporotic Mice. American Association for Dental Research (AADR), March 2016, Los Angeles, CA.

Lim, R. *, Shi, J., Kim, J.K., Pan, H.C., Reese, P., Chen, E., Zhang, Y., Lee, S., Wu, B., **Kwak, J.H.** (Senior author). Systemic NELL-1 Administration Regenerates Bone in Osteoporotic Mice. UCLA Research Day 2016. * 3rd place winner in Dental Student category.

(ii) Poster presentations and awards (AAOF award acknowledged in all):

Kwak, J.*, Shi, J., Pan, H.C., Chen, E., Zhang, Y., Lee, S., Ting, K., Wu, B., Soo, C. "Systemic NELL-PEG Therapy Regenerates Jaw Bones in Osteoporotic Mice". International Association for Dental Research (IADR), June 2016, Seoul, South Korea. * Selected as finalist for IADR Joseph Lister Award Poster Competition for New Investigators.

Chen, E. *, Khalilinejad, K., Choi, H.W., Lin, Y., Kwak, J.H. (Co-senior author), Moon, W. Dentoskeletal effects of Maxillary Skeletal Expander (MSE), a type of Micro-implant assisted Rapid Palatal Expander (MARPE), in adolescents and adults. 2016 California Dental Association (CDA) Poster Competition. * 1st place winner in Clinical Category.

Pan, H.C.* , Shi, J., Kim, J.K., Lee, S., Uyeda, M., Tanjaya, J., Reese, P., Ting, K., Kwak, J.H. (Senior author). "Novel Dual-energy X-ray Absorptiometry Analysis for Mice Trabecular Bone-rich Regions". American Association for Dental Research (AADR), March 2016, Los Angeles, CA.

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 a much needed financial stability, and thus allowed me more time to focus on the proposed career development goals in education, research, teaching, and clinical components.