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AAO Foundation Final Report Form
(a/o 6/30/2018)

Type of Award: Orthodontic Faculty Development Fellowship Award

Name(s) of Principal Investigator(s): Dr. Sudha Gudhimella

Institution: University of Louisville School of Dentistry

Title of Project: A Novel Nitric Oxide-Releasing Elastomeric Chain: Development of an Antimicrobial Orthodontic Ligature

Period of AAOF Support: 07-01-19 to 06-30-20

Amount of Funding: $20,000

Summary/Abstract:

Introduction: Microbial colonization of orthodontic elastomeric chains is a two-fold problem: (1) plaque promotes carious lesions during orthodontic treatment and (2) bacterial by-products can degrade a chain's mechanical properties. Efforts to combat this colonization have included the development of materials with antimicrobial activity. Recently, biomedical research has focused on the antibacterial properties of S-Nitroso-N-acetyl penicillamine (SNAP), a synthetic Nitric Oxide (NO) donor that exhibits extended NO release when incorporated into low water-uptake polymers. The objective of this study is to generate an antibacterial orthodontic elastomeric chain using this technology.

Methods: Elastomeric power chain is impregnated with the SNAP molecule and chains are evaluated for their Nitric Oxide release kinetics. The chains are then tested for their antibacterial efficacy against a common oral pathogen, Streptococcus mutans.

Results: Existing elastomeric chains are successfully impregnated with SNAP and show NO-release over a three-day period. Experimental chains demonstrate good S. mutans inhibition on and around the chain surface over a 48-h period.

Conclusions: Nitric Oxide-Release technology can be applied to products in the dental field and may allow for biomimetic materials that would help to reduce bacteria-related pathologies such as white spot lesions and gingivitis.

Questions:

1. Were the original, specific aims of the proposal realized? Yes, All the goals stated in the grant proposal's educational, clinical, teaching, and research categories were accomplished.
2. Part I of the research project fulfilled the requirements for the Orthodontic resident's master's thesis (Dr. Carly Warden). Additionally, Part II of the project served as the Master's thesis for the DMD/MSOB student (Dr. Alec McDonald).
3. Moreover, two additional DMD students (Amanda Dilliha and Krista Manche) provided assistance to the resident and MSOB student during the laboratory work, and as a result, they earned the necessary credits to be eligible for the summer research scholarship offered by the graduate school.

2. Were the results published? Yes, Part I of this project has been published. Part II – please see attached unpublished manuscript. We are in the process of submitting this manuscript for publication.

a. If so, cite reference/s for publication/s including titles, dates, author or co-authors, journal, issue, and page numbers.

Warden, Carly, Jinlian Tan, Kellianne M. Piell, Nandakumar Janakiraman, Mark E. Meyerhoff, Jill M. Steinbach-Rankins, Marsha P. Cole, and Sudha Gudhimella. "A novel, nitric oxide-releasing elastomeric chain for antimicrobial action: proof of concept." Materials Research Express 8, no. 9 (2021): 095309.

b. Was AAOF support acknowledged? Yes

c. If not, are there plans to publish? If not, why not? Yes, Part I of this project has been published. Part II – please see attached unpublished manuscript. We are in the process of submitting this manuscript for publication.

3. Have the results of this proposal been presented? Yes.

a. If so, list titles, author or co-authors of these presentation/s, year, and locations.

A Novel, Nitric Oxide-Releasing Elastomeric Chain for Antimicrobial Action: Proof of Concept. Alec McDonald, Dr. Carly Warden, Jinlian Tan MS, Jill Steinbach-Rankins, Marsha Cole, Sudha Gudhimella

Presentations:

1. S/RBM Annual Conference, November 2022 (Miami, FL)
2. AADOCR Kentucky Fall Symposium, September 2022 (Louisville, KY)
3. Research! Louisville, September 2022 (Louisville, KY) – 1st Place
4. IADR/APR General Session, June 2022 (Virtual)

5. Research! Louisville, October 2021 (Louisville, KY) – 2nd Place
6. AADOCR Kentucky Fall Symposium, October 2021 (Lexington, KY) – 2nd Place
7. IADR General Session, July 2021 (Boston, MA)
8. Research! Louisville, September 2022 (Louisville, KY)- 1st Place
9. 2023 AADOCR/CADR Annual Meeting & Exhibition (Portland, OR)

b. Was AAOF support acknowledged? Yes, AAOF support was acknowledged in every presentation.

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

The AAOF has played a vital role in my professional journey, supporting me both during my residency and now as an educator and researcher. The RAA grant I received while in residency provided funding for my thesis, while the two OFDA grants I obtained as a junior faculty at the University of Louisville were instrumental in establishing myself as a researcher and educator.

The opportunities enabled by the AAOF awards have significantly enhanced my resume. I am thrilled to share that I recently attained tenure and have been promoted to Associate Professor, and I owe a significant portion of this achievement to the support of AAOF grants. I am also grateful to AAOF for their cooperation and flexibility during the challenging times of COVID, as they worked with me in navigating the limitations in the labs and accommodating my NCE's and Rebudget requests.

Looking ahead, I am eager to apply for the Biomedical Research Award, as I aspire to continue my research endeavors and contribute further to the field. Once again, I extend my sincere gratitude to AAOF for their instrumental role in shaping my career and fostering my growth as an academic and researcher.

Accounting for Project: No funds remaining. Funds were used as budgeted.

Respectfully,

Sudha Gudhimella