Biodevices

The Committee is pleased that NIDCR is exploring how to leverage oral biodevices for overall health, including developing tools to detect bone loss. The Committee encourages NIDCR to continue focusing on novel products, such as imaging technologies and dental restorative materials, which can improve individuals' oral and overall health and well-being.

Action taken or to be taken:

Oral biodevices have immense potential for real-time monitoring of oral health and overall health, in addition to delivery of local and systemic treatments. Recent progress in wireless capability, nanotechnology, and microfabrication can now be leveraged to develop oral biosensors for a variety of uses. Since these devices will be placed in the mouth, they must be capable of withstanding the unique challenges of the oral environment — like chewing forces, microorganisms, and salivary enzymes. National Institute of Dental and Craniofacial Research (NIDCR)-supported researchers are creating oral biodevices such as an orthodontic pressure sensor capable of monitoring and controlling tooth movement, and a device for detecting bone loss to improve periodontal disease management and treatment. In addition, scientists are developing biosensors to measure salivary biomarkers to understand important aspects of overall health in real time. In pilot studies, researchers are measuring melatonin levels in patients with sleep disorders, and monitoring cortisol to detect changes in psychological stress levels, such as in post-traumatic stress conditions. These early studies will be expanded so that the biosensors can be tested further with a goal of facilitating the translation of clinically-validated oral biosensors into everyday practice.

NIDCR has been a leader in supporting the development of new products and devices to solve some of the challenging problems that dentists face in their clinical practice. For example, it is difficult for practitioners to diagnose cracked teeth and undetected cracks can result in tooth loss. NIDCR is supporting a small business to develop improved imaging tools that automatically visualize and measure cracks in teeth in 3D. NIDCR is also investing in research to improve the longevity and durability of the restorative materials that dentists use to treat dental decay. NIDCR-supported researchers are developing prototypes of new restorative materials such as resins, fillers, and adhesives. These new materials are not only stronger and longer-lasting, but researchers are also developing new features like the ability to self-heal and anti-microbial properties. Building on this momentum, NIDCR is launching a new initiative on digital dentistry that will advance research in personalized imaging, procedures, products, and devices.

Temporomandibular Disorders

The Committee is concerned that over 36,000,000 people, primarily women in their child-bearing years, are affected physically, financially, and emotionally by TMD. The Committee is aware that TMD are primarily a multi-system disorder with overlapping conditions influenced by multiple biological and environmental factors rather than solely an orofacial pain condition. Therefore, the Committee urges NIDCR to support multidisciplinary research and attract scientists across other disciplines to this research. At the same time, the Committee is encouraged by the scientific meetings between NIDCR, several Institutes and Centers as well as Temporomandibular Joint [TMJ] patient groups on an integrated systems approach of precision medicine related to cellular-molecular-genetic-epigenetic mechanisms related to diagnosis and treatment of TMD and its comorbid conditions. The Committee requests an update on initiatives that resulted from the recommendations that came forth from these meetings. Further, it applauds NIDCR's involvement in the TMJ Patient RoundTable to advance collaboration to work toward the common end of providing safe and effective treatments that improve patient's quality of life. The Committee encourages continued collaboration with governmental agencies and other stakeholders in the project.

Action taken or to be taken:

To encourage multidisciplinary research and attract scientists across other disciplines to temporomandibular disorder (TMD) research, the National Institute of Dental and Craniofacial Research (NIDCR) supports research training and career development programs designed to enhance research capacity in dental, oral, and craniofacial health, including TMD and orofacial pain. These programs span career levels and bring together scientists from a variety of basic, translational, and clinical research fields, including neuroscience, genetics, imaging, pharmacology, physiology, biomaterials, and bioengineering to tackle the problem of TMD and orofacial pain. Many of the scientists from these programs go on to obtain academic faculty and training positions and achieve subsequent individual research awards to continue to study TMD. As a member of the collaborative NIH Blueprint for Neuroscience Research program, NIDCR supports research training programs to help students pursue interdisciplinary areas of neuroscience, and to bring students from underrepresented groups into the neurosciences, including TMD and orofacial pain. In addition, NIDCR is supporting TMD research through a collaboration with the NCATS Clinical and Translational Science Awards (CTSA) Program, providing translational research training opportunities to scientists early in their careers. Through supplemental funding to the CTSA Mentored Career Development Awards, NIDCR is supporting a scholar studying the interactions between cells and their extracellular environment (matrix) in temporomandibular health and disease.

NIDCR agrees that involvement in the TMJ Patient RoundTable advances collaboration to work toward the common goal of providing safe and effective treatments that improve patient's quality of life. NIDCR recognizes the importance of these interactions and will continue to work with our Federal partners as well as TMJ patient groups on these efforts. Scientific meetings between NIDCR, several other Institutes and Centers as well as Temporomandibular Joint (TMJ) patient groups have provided recommendations to advance the diagnosis, treatment, and prevention of

TMD and associated overlapping pain conditions, using precision medicine approaches. Stemming from these recommendations, in 2018 NIDCR announced a new initiative to catalyze multidisciplinary research on TMD, including the evaluation of TMD animal models and analysis of the underlying biological mechanisms of how chronic TMD develops and how it can be resolved. As part of the NIH HEAL (Helping to End Addiction Long-term) Initiative and in collaboration with many other NIH Institutes and Offices, NIDCR is supporting efforts to promote discovery of strong candidate biomarkers and endpoints for pain conditions, including TMD, that can be used to facilitate development of non-opioid therapeutics.

Looking ahead, NIDCR and the NIH Office of the Director plan to support a National Academy of Sciences consensus study on temporomandibular disorders (TMD), from research discoveries to clinical treatment. The estimated start date of this project is fall 2018. The study will bring together an expert committee in an objective and independent environment that assures rigorous analysis to address the current state of knowledge regarding TMD research, education and training, safety and efficacy of clinical treatments of TMD, and burden and costs associated with TMD. The committee will identify approaches to advance basic, translational, and clinical research in the field and inform development of policies related to evidence-based treatment and clinical management of TMD patients.