

Oral Health Research at Dalhousie: A Picture of Diversity and Collaboration

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Research activity at all levels—from the initial stages of inquiry (the all-important “research question”) to large, multi-collaborative ventures—underpins the very knowledge that defines any academic discipline and what is ultimately brought to bear in practice. This is no less true in the didactic and clinical training of health professionals, including the dentists and dental hygienists who successfully complete our programs at Dalhousie University’s faculty of dentistry. A common thread running through these diverse activities is the desire to improve the oral health—and by extension, the general health—of individuals.

In a faculty known for its teaching innovations and quality student experience, research activities—including the early, pioneering work of individuals such as Drs. Derek Jones and Michael Cohen in the areas of dental materials and developmental connective tissue disorders, respectively—have historically occurred by and large in the background. With an exponential growth in research activity over the last decade, this faculty approaches its 100th anniversary sporting a rich and diverse research environment. Included here are core basic science research programs investigating oral pathogens or new implant materials, clinical research projects examining new treatment modalities, and a burgeoning community health-based research initiative concerning vulnerable populations. What follows is a snapshot of some of these activities. The picture that develops is one of diversity and collaboration, revealing projects that have the potential to impact clinical practice and patient care overall.

Applied Oral Science Research—From Bench Top to Chair Side

Many of the advances in patient care and treatment have roots in laboratory-based research projects. In the department of applied oral sciences, faculty members continue to fuel activities in biomaterials and microbiology, securing both infrastructure and operating funds. Of particular note are Dr. Yung-Hua Li’s efforts to interrupt bacterial communication and, in the process, the ability of these microbes to develop a tenacious biofilm on implant or tooth surfaces that makes them particularly resistant to antibiotics and the body’s natural defenses. A recent recipient of a New Investigator award from the Canadian Institutes of Health Research (CIHR), Dr. Li works with *Streptococcus mutans* and has synthesized an analogous molecule that makes this bacterium more sensitive to antimicrobial components.

Additional studies of *S. mutans*, and in particular the mechanisms by which they modulate the cell surface, have also been undertaken by Dr. Song Lee, whose group is further exploring the pathogenesis of, and immunity to, *Treponema denticola*, a periodontal pathogen. Through collaborations with the Canadian Centre for Vaccinology, Dr. Lee’s group is also investigating the use of recombinant *S. gordonii* as a vehicle for generating a live oral vaccine against childhood diseases such as pertussis.

Crucial to addressing tissue function, healing and regeneration, biomaterials remain an integral focus of this department. I am currently leading a group that has developed low-temperature processing strategies for producing unique calcium polyphosphate-based matrices for use in local therapeutic delivery, with efforts targeting deep bone infections typically requiring significant and sustained doses of antibiotics at the site in order to be eradicated. In collaboration with Dr. Jeff Dahn (Physics, Dalhousie), our group

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has also undertaken biocompatibility studies focused initially on efficiently quantifying adsorption of common blood proteins to a compositional library of metal or metal oxide surfaces synthesized by novel combinatorial sputtering methods. This cutting-edge approach has the potential to direct the “tailoring” of metallic implant surface chemistry to enhance overall performance.

While tissue engineering seeks to develop regenerative strategies for the complete re-growth of diseased or damaged tissues, Dr. Michael Lee’s research program examines the opposite end of the problem: how might day-to-day, sustained mechanical loading on these replacements and activity of the host inflammatory systems lead to failure of tissue-engineered constructs in the host? The Tissue Mechanics laboratory is using collagen physical biochemistry, mechanical fatigue simulation and the culture of phagocytic cells to address this question from various angles.

Research and Clinical Practice

Dental materials remain an essential part of any clinical practice. The increasing use of restorative composite resins—and the desire to broaden their applicability while enhancing the efficiency with which they are used chair side—underscores the groundbreaking research conducted by Dr. Richard Price in the department of dental clinical sciences. Dr. Price continues to build on a body of work that employs microhardness testing together with novel infrared spectroscopy methods to evaluate the effectiveness of curing lights in achieving optimal hardness and polymerization of composite resins. This information will likely help establish clinical guidelines regarding the most appropriate curing lights and settings.

Assessing treatment needs is also an integral part of any oral health care professional’s portfolio. Dr. Blaine Cleghorn, the assistant dean of clinics, is one of the principal investigators in a collaborative project sponsored by the National Institutes of Health that seeks to more accurately diagnose proximal surface caries. Using optical methods that combine Raman spectroscopy and optical coherence tomography, the team is developing a probe to assess changes in surface integrity and mineral content so that appropriate treatment or preventive strategies can be initiated.

Evaluating the impact of prescribed treatments using an evidence-based approach is equally vital to the dental profession. Dr. Kathy Russell, an orthodontist and chair of the IWK Cleft Palate Team, is 1 of the 6 original collaborators in the first inter-centre North American study (“Americleft”)

The Americleft Study: The First Inter-Centre North American Study of Treatment Outcomes for Patients with Cleft Lip and Palate

Although the landmark Eurocleft study for craniofacial anomalies was published in Europe in 2005, there was a need to create a similar inter-centre initiative in North America. Dr. Rusty Long, of Lancaster, Pennsylvania, was asked by Marilyn Cohen—a speech language pathologist and president of the American Cleft Palate-Craniofacial Association (ACPA) at the time—to lead a task force on inter-centre outcome studies in conjunction with the ACPA Research Committee, which I was chairing.

As a result of this collaboration and the efforts of many others, an inter-centre workshop focused on orthodontic outcomes for patients with cleft lip and palate was held in 2006, and the Americleft study was born. Along with Dr. Long and myself, 9 other participants attended the 2006 workshop in Lancaster: orthodontists Drs. Gunvor Semb (UK and Norway), Bill Shaw (US), John Daskalogiannakis (Canada), Ron Hathaway (US), Ana Mercado (US) and Eric Howard (US), along with Marilyn Cohen (US) and 2 residents from the Lancaster Cleft Clinic.

Since the initial meeting, the group continues to convene twice a year to refine the study. The original study focused on analyzing post-treatment orthodontic study models using the Great Ormond Street London and Oslo (GOSLON) rating system and has expanded to include cephalometric analyses, nasolabial esthetic assessments and the interrelationships between these treatment assessments.

The enormous number of treatment protocols that exist for patients with cleft lip and palate makes the examination of treatment outcomes a challenge. The task of standardizing treatment records and assessment methods is also compounded by the wide variation that exists between centres. However, the group has committed considerable time and effort to agree upon a valid and consistent methodology (see www.acpa-cpf.org/research/americleft.htm).

The initial phase of the Americleft Study is now complete and a series of 5 manuscripts focused on treatment outcomes for patients with complete unilateral cleft lip and palate have been submitted for publication. Potential areas of examination for secondary phases of the study include alveolar bone grafting, burden of care and nasal alveolar molding.

— Dr. Kathy Russell

on treatment outcomes for patients with complete unilateral cleft lip and palate (see sidebar). Critical to this study was the development of standardized treatment records and assessment methods from the myriad of approaches used by the various centres involved.

In addition to its contributions to cleft palate research, the department of oral and maxillo-facial sciences is involved in collaborative studies with the faculty of medicine focused on the diagnosis and treatment of patients with sleep apnea who have dentoskeletal deformities. Oral cancer also remains a major research theme within the department. Of note are ongoing studies of immunohistochemical markers detectable in oral premalignant lesions that may reveal important information about the etiology of oral cancer while improving diagnostic consistency and subsequent treatment.

Vulnerable Populations—A Community Approach

Oral health care providers appreciate the substantive impact oral health has on the health and well-being of our patients. However, some segments of society are not receiving adequate access to oral health care. As the only dental faculty serving the Atlantic provinces, Dalhousie recognizes that a regional commitment is essential to address the oral health needs of the population served. Our recent research efforts to address these disparities have been both incremental and high profile in nature (see p. 103). This research program has involved a strategy to build research capacity while garnering provincial and regional support for oral health surveys through CIHR-sponsored forums involving community members, health care providers, academics and health policy planners.

A cornerstone of these efforts is The Oral Health of our Aging Population (TOHAP), a cross-sectional survey of the oral health status and needs of Nova Scotians age 45 and older in which a total of 330 long-term care residents and 747 community residents were interviewed and examined. Early key findings indicate that individuals 65 and over are 3 times more likely to have untreated periodontal disease. Fifty percent of individuals living independently in the community were also found to have no form of coverage for dental care, with that figure increasing to 77% for those in long-term care. The TOHAP survey results will serve to inform other Canadian studies of this nature, with plans to expand the scope of this work to include aboriginal and new immigrant popula-

tions. Importantly, this dovetails with the faculty of dentistry's commitment to clinical outreach programs. Also closely tied to these initiatives is the groundbreaking research of Dr. Mary McNally involving ethics in clinical practice, access to care and oral health care delivery.

Can We Afford Research?

Academic researchers and university administrators alike often agonize over "the cost of doing research," a cost that is usually defined in terms of manpower, infrastructure and overhead costs. But it can be argued that there would be a greater cost involved if dental faculties shunned such activities. Simply put, research informs that which we are trained to put into practice, ultimately for the betterment of society. Its impact, then, cannot be measured so much in terms of dollars (although health economists could certainly build a good case for health promotion and prevention research). Rather, its influence is rooted in the knowledgeable dentists and dental hygienists providing the best possible care for their patients, and in health care policies and services that adequately recognize the importance of oral health care.

There is little doubt that this faculty will continue on its positive trajectory, growing a diverse and collaborative research enterprise that belies its relatively small size. Cooperation among the 3 health faculties at Dalhousie and the affiliated teaching hospitals to develop a unified health research strategy, including an integrated research training program, also bodes well for enhanced interdisciplinary and interprofessional research opportunities. Such efforts will complement the already existing interprofessional health care training opportunities available within the faculty, and together will provide an unparalleled educational, professional and research experience for our dentistry and dental hygiene students. ♦

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