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Naval Dental Research Institute

Great Lakes, Illinois

Dental problems continue to impair operational readiness and sustainability. Research has found that dental emergencies will afflict approximately 7% - 15% of operational forces (per annum). Given this, one important focus at the Naval Dental Research Institute (NDRI) is to examine the origins of dental emergencies, leading to increasingly sophisticated methods of risk assessment and prevention. Additionally, oral fluids are now recognized as providing tremendous opportunities for non-invasive and low cost screening of medical conditions that affect military readiness (incl., TB, Dengue Fever, Cholera). Salivary diagnostic technologies are extremely promising for their applicability to field use and in screening large populations. NDRI also provides science and technology leadership to the Navy regarding evolving public health and environmental concerns related to the operation of large dental treatment facilities.

NDRI focuses its expertise in oral biology, epidemiology, and materials science to develop products and solutions addressing militarily relevant capabilities, including:

- Identification of predictive risk factors for dental disease and emergencies.
- Development of rapid, salivary diagnostic screening tests for infectious diseases, immunization status, and decompression sickness.
- Longitudinal assessment of dental treatment needs among active duty personnel.
- Evaluation and implementation of technologies enhancing the Navy's ability to operate large dental treatment facilities with minimal environmental and public health impact.
- Support of the independent-duty corpsman to treat dental emergencies by the development of materials and expert system software to facilitate shipboard and war-zone care.

NDRI is strategically located on the Great Lakes Naval Training Center complex, home to 19 of the Navy's technical service schools and the only Naval Recruit Training Command. This unique location makes NDRI the center of choice to study dental health needs of recruits, track them through service school, and continue monitoring as they transition to the fleet. For over 50 years, researchers at NDRI have investigated problems related to oral health, disease, and injury and developed techniques and products to improve dental and medical care in the Navy. With the collocation of the Army Dental Research Detachment (1996) and the US Air Force Dental Investigation Service (2000), the Institute is now the site for all DoD dental research.

Beyond the available military expertise, NDRI is capitalizing on regional resources as researchers work cooperatively with other federal agencies, universities and private industry. The laboratory is located in the greater Chicago area with direct access to two dental schools, the American Dental Association, over 40 national dental organizations, six medical schools, two VA hospitals, and numerous scientific and industrial resources.

Research

Scientific Investigations

- Non-invasive, rapid (5 minutes or less) salivary tests are being developed (or envisioned) to detect salivary antibodies to Tuberculosis, Dengue Fever, Cholera, and a host of other communicable diseases.
- Analytical tests useful for the diagnosis and treatment monitoring of certain oral diseases are being developed and validated. Current tests utilize polyclonal antibodies towards specific pathogens or reactions specific to certain disease mechanisms.
- Parallel examination is being conducted of cytokine markers in blood and saliva related to acute inflammatory events associated with decompression sickness.

Biometrics and Public Health Dentistry

- Evidence-based assessment tools are being developed to help identify individuals at high risk for experiencing acute dental problems.
- NDRI is continuing to monitor the operational impact of various types of dental emergencies and is beginning to collect longitudinal data related to the origin of certain emergency categories.
- Multivariate statistical methods are being applied to redefine dental readiness incorporating: (i) demographic variables; (ii) evidence-based, risk assessment tools; (iii) along with dental health behaviors.
- Evaluate long and short-term consequences of treatment prioritization and sealant application.

Dental Support of Forward Deployed Troops

- Refinement, "beta testing", and delivery of a software-base expert system (Advanced IDC Dental Triage Informatics System) is being conducted.
- An interim treatment material is being developed (along with a new delivery system) for use by Independent Duty Corpsmen to ameliorate a wide variety of urgent dental problems.

Environmental Issues

- Existing and emerging technologies are being evaluated for removal of mercury from dental unit wastewater streams. NDRI is the lead agent in this important Navy-wide program.
- Design and coordinate the installation of mercury abatement systems in all Navy dental clinics worldwide.
- Evaluate technologies to remove biofilms from dental unit water lines or to prevent their formation.

Examples of Accomplishments

- Three oral diagnostic tests have been patented by NDRI and are now close to market entry via licensing opportunities: (i) MUST-mutans streptococcal test; (ii) LBT-lactobacillus test; (iii) PAT-protease activating test.
- Received grants from the Environmental Protection Agency's Great Lakes National Program Office to design, install, and evaluate pretreatment systems and to educate dental professionals.
- Designed, developed, and currently maintains Dental Mercury Web Site: http://dentalmercury.com
- Two patents awarded to NDRI for mercury pretreatment systems.
- Designed and/or installed pretreatment systems at six Navy dental treatment facilities.
- Selected as the expert agent to provide mercury release controls to the Tri-services Pentagon Dental Clinic.

Examples of Operational Support

- Developed the DDS/DMD software to enable computer-assisted diagnosis and treatment of dental conditions by Independent Duty Corpsmen.
- Assisted U.S. Army in developing reduced size and weight dental field equipment.