STRATEGIES FOR APPLICATION OF SCIENTIFIC FINDINGS IN PREVENTION

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Adv Dent Res 9(2):96-99, July, 1995

Abstract—Dental research in the last 50 years has accomplished numerous significant advances in preventive dentistry, particularly in the area of research in fluorides, periodontal diseases, restorative dentistry, and dental materials, as well as craniofacial development and molecular biology. The transfer of scientific knowledge to clinical practitioners requires additional effort. It is the responsibility of the scientific communities to transfer the fruits of their findings to society through publications, conferences, media, and the press. Specific programs that the International Association for Dental Research (IADR) has developed to transmit science to the profession and the public have included science transfer seminars, the Visiting Lecture Program, and hands-on workshops. The IADR Strategic Plan also has a major outreach goal. In addition, the Federation Dentaire Internationale (FDI) and the World Health Organization (WHO) have initiated plans to celebrate World Health Day and the Year of Oral Health in 1994. These are important strategies for the application of scientific findings in prevention.

Key words: Science transfer, IADR Strategic Plan, outreach.

Presented at the 4th World Congress on Preventive Dentistry, "Trends in Prevention—Promotion of Oral Health within General Health Care...Possibilities and Limitations in Preventive Dentistry", September 3-5, 1993, University of Umeå, Sweden, co-sponsored by the World Health Organization and the International Association for Dental Research

Genco (1991) emphasized that the research community has been entrusted with enhancing the oral health of our society, and with this trust comes the responsibility to transfer the fruits of our findings to society. He reviewed the accomplishments of the dental research community over the last 50 years and enumerated advances that have been made and successfully implemented and which have had major positive impact on the oral health care of the people in the world.

FLUORIDE RESEARCH

For example, the classic epidemiological studies of Dean and his colleagues (Dean, 1934; Dean and Elvove, 1936; Dean *et al.*, 1942) in the search for the etiology of mottled enamel have been among the most frequently cited literature in the history of public health (Wei and Chan, 1990). These studies eventually led to the successful implementation of water fluoridation projects in many parts of the world. The markedly reduced dental caries prevalence in children seen in the late 1950's and 1960's has been due primarily to the widespread adoption of water fluoridation (Chan and Wei, 1992; Murray, 1993). Further reductions have been achieved by the additional effects of fluorides when incorporated into mouthrinses, dentifrices, topical applications, prophylaxis pastes, and dental materials (Wei, 1990; König, 1993; Stephen, 1993; Kunzel, 1993; Petersson, 1993; Wei and Yiu, 1993a,b). Increased dental awareness and regular professional and home oral care, such as the integrated program in Sweden, have added further to the tremendous decline in dental caries in many parts of the world (USPHS, 1989; Brunelle and Carlos, 1990; Axelsson *et al.*, 1993; Wei *et al.*, 1993). Axelsson's program has dramatically shown the complete elimination of dental caries in 12-year-old Swedish children by 1994, from a high DFS index (Decayed and Filled Surfaces) of 40 in 1964 to 25 in 1974 to 3 in 1984.

There also has been much improvement in dentifrice formulations, which not only provide fluoride for the prevention of dental caries but also contain anti-tartar and anti-plaque agents, such as Triclosan/PVM/MA, for the control of plaque and gingivitis (Volpe *et al.*, 1993; Wei and Yiu, 1993c).

RESEARCH ADVANCES IN THE PERIODONTAL DISEASES

Advances also have been made in the identification of the pathogenesis of periodontal diseases. Several specific micro-organisms have now been shown to be directly associated with periodontitis, and anti-infective periodontal therapy directed toward suppressing or eliminating these specific periodontal pathogens has been developed. We now know a great deal more about susceptibility to periodontal diseases as well as about the competitive tissue components and their cellular functions which may affect the progress of

periodontal disease, particularly in tissue regeneration (Genco, 1991). There are considerably more data on the Community Periodontal Index of Treatment Needs (CPITN) in the WHO global oral data bank for the age groups 15-19 years, 35-44 years, and 65-74 years (Miyazaki *et al.*, 1992).

RESTORATIVE DENTISTRY AND DENTAL MATERIALS

There also have been significant advances in the area of restorative dentistry, with the achievement of the high-speed air-rotor handpiece and the latest developments in resin composites and light-cured glass-ionomer cements which enable esthetic dentistry to be accomplished on posterior and anterior teeth to a great degree of patient satisfaction (Wei and Barkmeier, 1992). The development of pit-and-fissure sealants has also been a significant preventive measure, so that incipient caries lesions need not develop to full cavitation requiring extensive restorations (Stamm, 1984; Simonsen, 1987; Ripa, 1993). Dentin bonding agents have added a new dimension to the repair of teeth fractured due to trauma. The development of porcelain veneers and onlays and improvements in properties of various types of porcelains have greatly increased their esthetics and durability (Wei and Tang, 1989; Wei *et al.*, 1989; Cooke and Wei, 1993).

MOLECULAR BIOLOGY AND OTHER RESEARCH ADVANCES

There also has been a great deal of molecular biology research in the area of craniofacial development. Extensive efforts have been made to identify the genes responsible for defects such as cleft lip and palate, with the goal of achieving an understanding of the mechanisms responsible for these anomalies so that preventive and corrective therapies can be developed. There also have been tremendous advances in our understanding of infection control in dental practice, such that the infection control procedures today are much more rigorous than only a short five years ago (Samaranayake *et al.*, 1991; Scully and Samaranayake, 1992).

TRANSFER OF SCIENCE TO DENTAL PRACTICE

Nakata (1990) emphasized that implementation of scientific innovations is most important to advances in both dental science and the dental care system. There is a tremendous amount of scientific information which is developed by dental researchers and not always effectively and efficiently utilized. Both dental academics and practitioners must improve their strategy to communicate new findings as efficiently as possible to our dental colleagues and to the public, so that such innovations will be accepted and successfully implemented.

Nakata (1990) believed that new innovations are usually scrutinized according to five major criteria: (1) relative advantage, (2) compatibility, (3) complexity, (4) availability to be tested, and (5) ability to be observed. It is also a well-recognized phenomenon,for either an individual or a society, that the adoption of innovations is not a single-unit act. This adoption process requires a change in human behavior which may be categorized into five stages: 'Awareness', 'Evaluation', 'Trial', 'Adoption', and 'Confirmation'.

In communication, much of the information seems to flow by a diffusion process; that is, the knowledge flows from scientists to dental practitioners *via* journals, professional meetings, and/or contacts with other professionals. Dental practitioners then make individual decisions to accept or reject a new idea on the basis of the information available to them. "Awareness" occurs at a more rapid rate than "adoption" or "acceptance". Obviously, it will take professional judgment to determine and "evaluate" whether any innovation is sufficiently advanced for clinical testing.

Nakata (1990) also suggested that there is a commitment of acceptance and adoption. Generally, dental practitioners may be classified as 'Innovators', 'Early Adopters', 'Early Majority', 'Late Majority', or 'Laggards'. While innovators are usually progressive and eager to try out new ideas, early adopters are usually known opinion leaders.

There does not seem to be a well-organized structure to encourage an individual dentist to adopt innovations independently. Dental researchers must therefore not only be innovative but also should work with the infrastructure of science transfer and dissemination whereby their innovations can be adopted quickly and widely to benefit the oral care of all.

PROGRAMS OF THE IADR

(1) Science Transfer Seminars

The IADR has taken a leadership role in science transfer by organizing science transfer seminars at some of its annual sessions. A very successful program was organized at the Annual Session in Acapulco, and hundreds of Mexican dentists benefited from the communication of new dental scientific findings. Additional programs of science transfer have been successfully implemented at each of the IADR General Sessions in Chicago, San Francisco, and Seattle, and an exciting program has been planned for Singapore.

(2) Visiting Lecture Program

Another program promoted by the IADR is the Visiting Lecture Program. The first one of its kind will be in Sri Lanka and Indonesia in 1995. After consultations with local educators and dental leaders in those regions, a tailor-made program of training to meet local needs will be developed. The visiting scientists will be carefully selected to address the areas of need for those regions of the world. Visiting lecturers in key areas will be selected for such programs by IADR in the future.

(3) Hands-on Workshops

On a smaller scale, the annual session of the IADR now includes hands-on workshops on various topics so that dental researchers can get hands-on training in various advanced techniques and methodologies from leading scientists and technicians in certain areas of dental research development. These workshops have been very successful and were heavily over-subscribed at the Seattle meeting. More workshops have been planned for future annual sessions of the IADR.

(4) Goal of global mission

My IADR Presidential goals were to carry out our global

TABLE

ORAL HEALTH GOALS IN HONG KONG BY 2010 AND 2025

Age	2010	2025
12 years old	(a) 70% are caries-free in their permanent dentition.	(a) 85% are caries-free in their permanent dentition.
	(b) DMF* index is 1 or less.	(b) DMF index is less than 1.
18 years old	(a) 60% are caries-free.	(a) 85% are caries-free.
	(b) DMF index is 2 or less.	(b) DMF index is less than 1.
	(c) 90% are free of shallow periodontal pockets.	(c) 90% are free of shallow periodontal pockets.
	(d) 60% should have no more than 3 bleeding sextants.	(d) 60% should have no more than 2 bleeding sextants.

*DMF index is a measurement of the prevalence of dental caries. Each **D**ecayed, **M**issing due to caries, or **F**illed tooth is given a score of one. The total number of affected teeth is an expression of an individual's dental caries experience. The DMF index of a group is calculated by dividing the total number of affected teeth in the group by the number of individuals in the group.

mission in the communication, dissemination, and promotion of research worldwide (Wei, 1993). The IADR Board of Directors has approved the formation of a new *ad hoc* committee on communication and technology, and its charge is to "Review advanced technology and communications systems applicable to the IADR/AADR". The key criteria for consideration will be that the system selected should have positive, practical benefits to the membership of the Associations (Wei, 1993). The committee is studying ways of increasing the availability and applicability of advanced technology and telecommunications systems for use by the Associations, and has made recommendations to the Boards of Directors.

FDI COMMISSION

The new FDI Commission has been approved by the General Assembly during the 1992 annual meeting in Berlin, and it has been re-structured from the previous four commissions into one FDI Commission which encompasses all major areas of education, research, and dental materials, etc., under one umbrella to facilitate the transfer of science to clinical practice more efficiently (Mjör, 1993). The FDI Commission should prove to be a valuable resource of science transfer to our profession and the public.

WORLD HEALTH DAY AND YEAR OF ORAL HEALTH

The first step to improving oral health is to increase oral health awareness, particularly in developing countries. The celebration of the World Health Day and the Year of Oral Health at the World Health Organization and the FDI appears to be the ideal time to develop and implement strategies for Government agencies, military establishments, dental associations, dental research centers, dental schools, and oral-health-related industries (Ross, 1994; Zillén, 1994).

Many developing countries and their Governments are looking for leadership and guidance in the codification of oral health care policies aimed at the primary preventive care levels. There are no better authoritative sources than the WHO, the IADR, and the FDI to provide such leadership. A concerted effort of the dental community is needed to adopt WHO projects throughout the world in areas of prevention, education, and research. Two specific examples of preventive dentistry projects on a national scale are those in China and Hong Kong.

WHO INITIATIVES IN CHINA

In 1982, the WHO in the Western Pacific Region sponsored a three-week intensive course in preventive dentistry in the People's Republic of China. Teachers of preventive dentistry from all parts of China were invited to attend the course in Beijing. They were given the theoretical basis of preventive dentistry, the practical aspects of motivation, and hands-on training in the development of pathfinder surveys, which were conducted in rural and urban areas in and around Beijing. This was the cornerstone of modern-day preventive dentistry in China, because, as these teachers from all over China returned to their cities and provincial centers, they continued to conduct pathfinder surveys and later definitive epidemiological surveys. A huge body of oral health data has been collected by Chinese dental researchers and their collaborators, and such publications are now widely available (Wei *et al.*, 1986; Wright *et al.*, 1989).

In the People's Republic of China, a national preventive dentistry program has been successfully launched with the "Love Tooth Day" (LTD). Furthermore, discussions on the possibility of implementing water fluoridation in China have also been held in Guangzhou (Chan and Wei, 1992).

HONG KONG: "BRIGHTER SMILES FOR THE NEXT GENERATION"

The Department of Health of the Hong Kong Government has recently taken a major initiative to develop an entirely new oral health program aimed at kindergarten children and their teachers as well as maternity health care centers and their staff. A new package of teaching materials and audio-visual aids has been assembled for distribution to paradental professionals who will be recruited and trained to teach preventive dentistry at the primary care level. The bilingual theme that was developed, "Brighter Smiles for the Next

Generation" (in Chinese and in English), is a most fitting slogan. Not only has this program been launched successfully, but there are also plans and methods aimed at evaluating its impact on the community oral health in the future. Operational goals for Hong Kong for the years 2010 and 2025 have also been developed, as shown in the Table. The development of achievable goals is the first step in forming a strategy for prevention. This applies to a country as well as to a single treatment plan for an individual patient (Chan, 1994).

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