Changing Trends in Dental Biomaterials Science

Ralph W. Phillips, MS, DSc, Editor

Never has there been an era as frustrating, yet as challenging, as that of today, particularly as it relates to an avalanche of new materials for all phases of dental practice and dramatic changes in their mode of usage. The practitioner must be able to separate fact from fiction in what the scientist and the manufacturer report, and then modify clinical procedures accordingly. It is fair to predict that these advancements will continue to escalate and pose increasing problems in remaining abreast of the ever-accruing body of knowledge.

Thus it is appropriate to present an overview and share a few thoughts regarding certain trends that have surfaced in dental materials science, since it is those trends that are in time reflected in commercial products and clinical techniques.

One such trend is a greater interest in the biological characteristics of materials. The materials scientist now appreciates that although physical and chemical properties are paramount in the design of a material to meet the demands of the oral environment, properties such as adhesion, corrosion resistance, and strength are unimportant if the system is not compatible with oral tissues. Histological documentation as to biocompatibility of a product is the first item that should be requested of the manufacturer marketing a new material, particularly in the area of implantology.

As is well known, The Council on Dental Materials, Instruments and Equipment of the American Dental Association includes a biocompatibility screening test in its specification and acceptance programs, as is also true for international specifications developed through the International Standards Organization. Likewise, the Food and Drug Administration in the United States (and comparable governmental agencies in other countries) includes dental materials and devices under its regulatory umbrella.

Greater emphasis is now also being placed on the search for more predictable laboratory tests that will accurately reflect what will happen in the in vivo situation. This continues to be the most intriguing area in materials research, bridging the gap between the laboratory and the clinical situation. For example, a host of scientists have been trying to develop a laboratory test for wear resistance of posterior composite resins that will predict wear 10 years hence in the oral cavity. Such a test would reduce the urgency for conducting costly, time-consuming clinical studies and would simplify the screening of new formulations that have the potential to improve clinical performance. Certainly better in vitro tests are needed for screening materials formulations for dental implants. For example, a test that would measure the bond strength of bone to the implant as related to surface preparation could provide a useful screening technique in implant design—*if* such a test could be

correlated with the in vivo situation.

The lack of such predictive tests has led to a mushrooming of clinical investigations, particularly for adhesive systems. Such studies, carried out in an *organized* manner with proper criteria for monitoring behavior, appropriately receive a high priority in dental materials programs.

Recently, more nondental manufacturers have begun to produce dental products, using dental materials as an outlet for their expertise in other industrial applications. For example, certain new ceramics and castable glasses originate primarily from nondental companies. Several posterior composites come from sources that have not previously been involved in dentistry. There is no doubt that one can anticipate increasing competition from industrial concerns for a portion of the dental materials market.

There is one last trend that should be cited, and it is a very significant one in the United States. When discussing restorative dentistry in the United States 10 years ago, one seldom mentioned a foreign-made product. That is no longer the case. The scientist, or dentist, who is not conscious of the contributions of researchers and manufacturers from throughout the world is doing a disservice to the profession. For example, the polyacrylic acid-based cement systems originally came from England and Japan. Light-cured and microfilled resins stemmed principally from Europe, while the first dentin bonding agent originated in Japan. Thus dental science and dental practice truly are international.

This ends a short glance at only a few of the exciting things taking place in biomaterials through new products and concepts. However, as has been intimated, while research solves problems it also creates others. It is hoped that this discussion may have whetted the appetite of the audience of this *Journal* for the ever-changing menu being offered through biomaterials research.