American National Standard/
American Dental Association
Specification No. 41

Recommended Standard Practices for Biological Evaluation of Dental Materials

American Dental Association
Council on Scientific Affairs 2005

AMERICAN NATIONAL STANDARD/AMERICAN DENTAL ASSOCIATION SPECIFICATION NO. 41 FOR RECOMMENDED STANDARD PRACTICES FOR BIOLOGICAL EVALUATION OF DENTAL MATERIALS

The Council on Scientific Affairs of the American Dental Association has approved American Dental Association Specification No. 41 for Recommended Standard Practices for Biological Evaluation of Dental Materials. This and other specifications for dental materials, instruments and equipment are being formulated by working groups of the ADA Standards Committee on Dental Products (formerly Accredited Standards Committee MD156 for Dental Materials, Instruments and Equipment). The Committee has representation from all interests in the United States in the standardization of materials, instruments and equipment in dentistry. The Council has adopted the specifications, showing professional recognition of their usefulness in dentistry, and has forwarded them to the American National Standards Institute with a recommendation that the specifications be approved as American National Standards. The American National Standards Institute granted approval of ADA Specification No. 41 as an American National Standard on December 22, 2005.

The Council thanks the working group members and the organizations with which they were affiliated at the time the specification was developed: Yiming Li (Chairman), Loma Linda University, Loma Linda, CA; Angela Blackwell, Center for Devices and Radiological Health-FDA, Rockville, MD; Paul M. Bralower, American Dental Association, Chicago, IL; An-Shih Cheng, Cheng & Associates, Chicago, IL; Scott Erickson, 3M ESPE, St. Paul, MN; Stephen Gruninger, American Dental Association, Chicago, IL; Carl T. Hanks, University of Michigan, Ann Arbor, MI; Steve Jefferies, Dentsply International, York, PA; Elisabet L. Kostoryz, University of Missouri-Kansas City, Kansas City, KS; Elden Lamprecht, 3M ESPE, Minneapolis, MN; Jack Lemons, University of Alabama, Birmingham, AL; Milton Marshall, Texas Heart Institute, Houston, TX; Ken Nakatani, 3M ESPE, Minneapolis, MN; Cornelis Pameijer, University of Connecticut, Farmington, CT; Ros Randall, 3M ESPE, St. Paul, MN; Pamela Scott, U.S. Food & Drug Administration, Rockville, MD; and Chakwan Siew, American Dental Association, Chicago, IL.

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FOREWORD

(This Foreword does not form a part of ANSI/ADA Specification No. 41 for Recommended Standard Practices for Biological Evaluation of Dental Materials).

This Specification is a revision of ANSI/ADA Specification No. 41, which was approved in 1979, and ANSI/ADA Specification No. 41a, an addendum that was approved in 1982. Both documents were reaffirmed in 2001.

This revision was prepared by the ADA Standards Committee on Dental Products (SCDP) Joint Working Group 1.

The objective of this Specification is to provide detailed guidelines and methodologies for evaluating the biocompatibility of dental materials following International Standard ISO 7405-1997, Dentistry — preclinical evaluation of biocompatibility of medical devices used in dentistry–test methods for dental materials. Therefore, the document is intended to serve as an annex to ISO 7405-1997 for the benefit of United States dental professionals, scientists and manufacturers.

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CONTENTS

AMERICAN NATIONAL STANDARD/AMERICAN DENTAL ASSOCIATION SPECIFICATION NO. 41 FOR RECOMMENDED STANDARD PRACTICES FOR BIOLOGICAL EVALUATION OF DENTAL MATERIALS

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1 SCOPE

This document covers standard practices for the biological evaluation of the safety of dental materials, including those with pharmacological agents as an integral part of the material.

2 INTRODUCTION

Biological evaluations of medical devices, including dental materials, are performed to determine the potential toxicity resulting from contact of the component materials of a device with the body. The device materials should not (either directly or through the release of their material constituents): (i) produce adverse local or systemic effects; (ii) be carcinogenic; or, (iii) produce adverse reproductive and developmental effects. Therefore, evaluation of any new dental materials intended for human use requires data from systematic testing to ensure that the benefits provided by the final product will exceed any potential risks produced by device materials.

When selecting appropriate tests for the biological evaluation of a dental material, one must consider the chemical characteristics of device materials and the nature, degree, frequency and duration of its exposure to the body. In general, the tests include: acute, sub-chronic and chronic toxicity; irritation to skin and oral mucosal surfaces; sensitization; genotoxicity; carcinogenicity; and usage tests. Depending on characteristics and intended uses of the dental materials, as well as the nature of contact, these general tests may not be sufficient to demonstrate the safety of some specialized dental materials. Additional tests for specific target organ toxicity, such as neurotoxicity and immunotoxicity may be necessary. The specific clinical application and the materials used determine which tests are appropriate.

Some devices are made of materials that have been well characterized chemically and physically in the published literature and have a long history of safe use. For purposes of demonstrating substantial equivalence of such dental materials to other marketed products, it may not be necessary to conduct all tests suggested in the biocompatibility test matrix. Scientific judgment should be used to determine which tests are appropriate.

ISO 10993 Standard, Part 1, uses an approach to test selection that is similar to the Tripartite Guidance, which it replaced. This revision also uses a tabular format (matrix) for laying out test requirements based on the factors discussed above. The matrix consists of two tables: Table 1 - Preclinical Evaluation Tests for Biocompatibility of Dental Materials, and Table 2 - Supplemental Tests Specific for Dental Materials. Information in these tables will assist in determining appropriate toxicology tests for dental materials. Each device will be considered on its own merits, and while not all tests listed are applicable for all dental materials, additional tests not indicated in the tables may be necessary to determine safety. The test matrix is only a framework for selecting tests, not a checklist of every required test. Manufacturers should determine the appropriate tests prior to the initiation of expensive, long-term testing of any new dental materials. A justification for the choice of all methods should be included in the test report. This is of particular importance when methods not included in this International Standard are used. All dental materials should be re-evaluated for biocompatibility when substantial revisions or modifications in formulation, quality, and/or performance specifications are made.

The current documents describing selection of tests for biocompatibility are ISO 10993-1 and the U.S. FDA Blue Book Memorandum, G95-1; tests specific to dental materials are described in ISO 7405). Excerpts from these documents are included to provide a framework for selection of tests needed to determine biocompatibility of dental materials. Should these documents be amended, the most recent version should be consulted. The blue book memorandum G95-1 entitled "Use of International Standard ISO-10993, Biological Evaluation of Medical Devices Part-1: Evaluation and Testing," includes an FDA-modified matrix that designates the type of testing needed for various medical devices