



American National Standard/
American Dental Association
Standard No. 132

Scanning Accuracy of Dental Chairside and Laboratory CAD/CAM Systems

ADA American
Dental
Association®
Council on
Scientific Affairs

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**AMERICAN NATIONAL STANDARD/AMERICAN DENTAL ASSOCIATION STANDARD NO. 132 FOR
SCANNING ACCURACY OF DENTAL CHAIRSIDE AND LABORATORY CAD/CAM SYSTEMS**

The Council on Scientific Affairs of the American Dental Association has approved American Dental Association Standard No. 132 for Scanning Accuracy of Dental Chairside and Laboratory CAD/CAM Systems. This and other standards for dental materials, instruments and equipment are being formulated by working groups of the ADA Standards Committee on Dental Products. 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 standards, showing professional recognition of their usefulness in dentistry, and has forwarded them to the American National Standards Institute with a recommendation that the standards be approved as American National Standards. The American National Standards Institute granted approval of ADA Standard No. 132 as an American National Standard on May 29, 2015.

The ADA Standards Committee on Dental Products thanks the members of Working Group 9.66 on Scanning Accuracy of Dental Chair-Side and Laboratory CAD/CAM Systems and the organizations with which they were affiliated at the time the standard was developed:

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FOREWORD

(This Foreword does not form a part of ANSI/ADA Standard No. 132 for Scanning Accuracy of Dental Chairside and Laboratory CAD/CAM Systems).

Within the last two decades, the field of 3-dimensional (3D) optical metrology has had a significance impact in the field of dentistry. The use of Dental Chairside and Laboratory CAD/CAM systems has become commonplace. However, no ANSI standard has been released that describes the relevant technical requirements. ADA/ANSI Standard 132 provides a comprehensive procedure to evaluate 3D optical metrology systems used in dentistry.

This standard describes three test objects that represent typical dental scanning parameters use to assess the accuracy, repeatability and reproducibility of 3D optical metrology systems. Additionally, this standard describes the test analysis methods and the acceptable relative error for dental chairside and laboratory CAD CAM systems.

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1 SCOPE

This standard describes test methods used to evaluate the repeatability, reproducibility and accuracy of dental devices for 3D metrology. The standard is applicable to dental chairside and dental laboratory CAD/CAM systems. The scope of this document is not intended to include unique systems with other specific applications of 3D metrology in the dental field such as 3D computed tomography, magnetic resonance imaging and stereophotogrammetry.

2 GENERAL CONSIDERATIONS

2.1 Terms and definitions

For the purposes of this document, the following terms from ISO 3534-1 apply:

accuracy -- the closeness of agreement between a test result and the accepted reference value. Here “a test result” denotes an observed, calculated or estimated value and “the accepted reference value” denotes the true value

precision -- the closeness of agreement between independent test results obtained under stipulated conditions. The term “repeatability” describes the precision value obtained in independent measurements that are performed under similar conditions, whereas the term “reproducibility” describes the precision value obtained in independent measurements that are performed under different conditions

relative error – the error of measurement divided by the true value of the measurement

repeatability – the closeness of the agreement between the results of successive measurements of the same distance carried out under the same conditions of measurement

reproducibility – the closeness of the agreement between the results of measurement of the same distance carried out under changed conditions of measurement. Reproducibility conditions shall be: a minimum of two operators and the minimum and maximum of the recommended environmental temperature

reproduction of detail – the system will accurately reproduce the specific characteristics of the test specimens

test measurement procedure – the application of procedures designed with specific parameters to test the performance results of applicable measuring /scanning systems

trueness – the closeness of agreement between the average values obtained from a large series of test results and the accepted reference value.

true value – the value consistent with the definition of a given particular quantity.

NOTE 1 These definitions imply that the most relevant term for the evaluation of measuring results obtained by means of 3D metrology is accuracy. In this standard the process of performing a measurement using means of 3D optical metrology is termed “scanning”. When the accuracy is high, precision and trueness are high as well, as shown in Figure 1.

NOTE 2 The terms accuracy, precision, and trueness are qualitative concepts that should not be used as synonyms for the corresponding quantitative measures, which need to be specified in statistical terms (e.g., standard deviation).

2.2 Accuracy evaluation

The evaluation of the accuracy obtained in 3D metrology cannot be generalized. When such an evaluation is accomplished, the following aspects need to be taken into account:

- A Test specimen: In order to ensure that the accuracy evaluation yields a meaningful result, test objects need to be defined that account for the special geometries and appropriate reflective surfaces that exist in the application of 3D optical metrology to the dental field (see Section 3 for a detailed description of relevant test objects).