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## Dentistry — Colour tabs for intraoral tooth colour determination

*Médecine bucco-dentaire — Plaquettes de teinte pour la  
détermination de la teinte dentaire intra-buccale*

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Published in Switzerland

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 106, *Dentistry*, Subcommittee SC 2, *Prosthetic dental materials*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

In dentistry, colour matching, colour communication among dentist and dental technician (indirect restorations) and colour reproduction and verification are essential elements for a successful aesthetic restoration. Other important appearance attributes include translucency/opacity, gloss, opalescence and fluorescence.

Questions regarding the principles of chromatics and the individual colour perception have been controversially discussed for years between those involved. Today, various systems are available for the purpose of objectivizing tooth colour perception. The most common method is the colour comparison using reference colours being supplied in the form of shade guides consisting of tooth shaped colour tabs made of ceramic, for a dental colour system. The objective of this document is to specify test methods for such colour tabs. This document does not cover colour samples, which are produced by each manufacturer to demonstrate colour effects usually of all components of a given individually designed assortment. These colour samples are not used to determine the colour *in vivo* and are not provided in a tooth-shaped form.

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# Dentistry — Colour tabs for intraoral tooth colour determination

## 1 Scope

This document specifies requirements for tooth-like colour representations made of ceramic materials used to determine the tooth colour in the patient's mouth or to check the colour of dental prosthesis, which are referred to as colour tabs in this document.

The colour coordinates of colour tabs are left to the manufacturers' discretion.

Resources for visualizing the colours of ceramic and other masses, e.g. mass shade guides and colour patterns for certain ceramic and other masses, do not fall into the scope of this document. They can be manufactured from any materials and serve solely to illustrate the colour effect; they do not serve to determine colour inside the mouth.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1942, *Dentistry — Vocabulary*

ISO 8601-1, *Date and time — Representations for information interchange — Part 1: Basic rules*

ISO 8601-2, *Date and time — Representations for information interchange — Part 2: Extensions*

ISO 11664-2, *Colorimetry — Part 2: CIE standard illuminants*

ISO 15223-1, *Medical devices — Symbols to be used with medical device labels, labelling and information to be supplied — Part 1: General requirements*

ISO/TR 28642, *Dentistry — Guidance on colour measurement*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1942 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

### 3.1 colour difference

single number or metric expressing the distance from complete match in colour or shade

Note 1 to entry: A colour distance metric defined by the International Commission on Illumination (CIE) is called delta E ( $\Delta E$ ).

Note 2 to entry: Two formulae for calculating  $\Delta E$  are recommended in this document: CIELAB or CIE 76 (denoted  $\Delta E^*_{ab}$ ) and CIEDE2000 (denoted  $\Delta E_{00}$ ). CIEDE2000 formula is currently the most advanced one and is recommended by CIE as it exhibits better correlation with visual findings compared with CIELAB.

**3.2  
colour coordinate**

set of three independent colour components required for the unique description of any colour in a defined colour coordinate system

EXAMPLE CIE-Lab ( $L^*a^*b^*$ ), CIE LCH\*, CIEDE2000 ( $L^*C^*h'$ ).

**3.3  
colour sample**

colour representation, corresponding as exactly as possible to a discrete colour of a *tooth colour* (3.6) system

Note 1 to entry: A colour sample can be manufactured from any material and serves solely to illustrate the colour effect; it is not to be used for colour determination inside the mouth.

**3.4  
colour tab**

body similar in shape and colour to a tooth, which is manufactured from at least two layers of ceramic materials and represents as exactly as possible a discrete colour of a tooth colour system

Note 1 to entry: The colour tab is usually fixed to a holding pin intended to enable positioning of the colour tab close to the patient's tooth without major occlusions.

**3.5  
shade guide**

arrangement of *colour tabs* (3.4) representing in their entirety a manufacturer-specific tooth colour system and serving for the visual (intraoral) determination of the patient's tooth colour by means of comparing the latter with the colour tabs of the shade guide.

Note 1 to entry: Usually, the colour tabs are set in (a) joint holder/s, with colour tabs being removable from the holder.

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**3.6  
tooth colour**

(true) value of the measurand tooth colour

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Note 1 to entry: This definition is adapted for the context of this document and according to JCGM 100:2008 (Joint Committee for Guides in Metrology).

**3.7  
countershape**

surround that accommodates a *colour tab* (3.4)

Note 1 to entry: Also known as "mould".

**4 Requirements**

**4.1 Materials and processing**

Colour tabs shall be manufactured from at least two layers of ceramic materials.

NOTE The exact structure of the colour tab as well as the composition and the processing of the materials are at the manufacturers' discretion.

**4.2 Appearance**

Colour tabs used to intraorally match the shades of natural teeth shall provide toothlike shapes.

Note 1 to entry This is to provide a shape the user is familiar with. Many years of clinical experience show that tooth shaped tabs lead to an intuitive handling of the tabs.



### 4.3 Uniformity

The measured colour coordinates of the colour tab shall match the colour coordinates of the tooth colour system within certain tolerances that are subject to the manufacturer's definition.

In the absence of any manufacturer's definition, the perceptibility threshold defined in ISO/TR 28642:2016 ( $\Delta E^*p = 1,2$ ) shall be used as the tolerance.

### 4.4 Cleaning and disinfection

Manufacturer's instructions for use must describe the methods and agents for cleaning, disinfection or sterilization. The given procedures, cleaners and disinfectants shall not affect the colour stability of the colour tab.

### 4.5 Colour stability

If the cleaning instructions given by the manufacturer are complied with and unless no other information is given by the manufacturer, the maximum colour difference declared by the manufacturer shall apply for a period of at least 5 years from the date of manufacture. If the manufacturer did not specify a maximum colour difference, the perceptibility threshold defined in ISO/TR 28642: ( $\Delta E^*p = 1,2$ ) shall be used as the maximum acceptable difference.

## 5 Test method for colour measurement

### 5.1 Test devices and test equipment

#### 5.1.1 Spectrophotometers

##### 5.1.1.1 Spectrophotometer with Ulbricht sphere to the following specifications:

|  |  |
|--|--|
| Measurement geometry                       | d/8° sphere geometry   |
| Repeatability                              | below 0,02 $\Delta E$ (r.m.s.) on a specified surface                                    |
| Compliance of device with reference device | below 0,15 $\Delta E$ (r.m.s.) on a specified surface                                    |
| Spectral range                             | Max. lower limit of spectral range: 400 nm<br>Min. upper limit of spectral range: 700 nm |
| Spectral resolution                        | 10 nm  |
| Photometric range                          | 0,0 % to 200 % reflection  |
| Photometric resolution                     | below 0,01 %   |

#### 5.1.1.2 Other spectrophotometers (e.g. spectroradiometer)

|                      |  |
|----------------------|--|
| Measurement geometry | 45°/d optical geometry (unidirectional, bidirectional or circumferential), |
| Background           | with or without  |
| Spectral resolution  | 1 nm–5 nm  |

The other specifications should be the same or similar as listed in [5.1.1.1](#).