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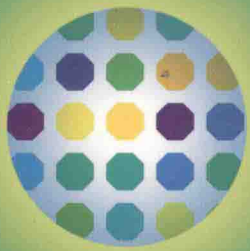
Esthetic Color Training in Dentistry



Interactive CD-ROM Inside

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Esthetic Color Training in Dentistry

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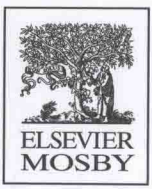

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NOTICE

Dentistry is an ever-changing field. Standard safety precautions must be followed, but as new research and clinical experience broaden our knowledge, changes in treatment and drug therapy may become necessary or appropriate. Readers are advised to check the most current product information provided by the manufacturer of each drug to be administered to verify the recommended dose, the method and duration of administration, and contraindications. It is the responsibility of the licensed prescriber, relying on experience and knowledge of the patient, to determine dosages and the best treatment for each individual patient. Neither the publisher nor the author assumes any liability for any injury and/or damage to persons or property arising from this publication.

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To my wife Ana and my children Dušan and Milica,
for painting my life with the most beautiful colors.

To my parents, Dušan and Mirjana, prominent university professors,
for the support that started with genes and never stopped.

To my teachers and friends in Serbia, Ljubisav Igic, Tomislav Pavlovic, Dragutin Stankovic, and Darinka Stanisic-Sinobad, for their priceless help.

To my colleagues from UT Dental Branch at Houston,
for their collaboration and friendship.

Rade D. Paravina

To my mentor and friend, Robert G. Craig (1923-2003).

John M. Powers

Foreword

At times our own light goes out and is rekindled by a spark from another person. Each of us has cause to think with deep gratitude of those who have lighted the flame within us.

Albert Schweitzer

How It All Started

When Rade sent me the outline of this book, he suggested that I might be interested in contributing. Since my active role in color research ended 30 years ago, my contribution would have most likely been hopelessly out of date. Researchers have gone to areas where I have not ventured. I explained my misgivings and said that the only thing I could tell with authority was how it was in the "olden days," and suddenly I had a commitment for *How It All Started.*

As I searched for answers to the confusion in color concepts in the 1960s, E. Bruce Clark emerged as my hero. In the 1930s he had seen the problems in color matching (these problems still existed in the 1960s and seemingly exist nowadays) and had mapped out a solution through publications, lectures, and a shade guide based on the Munsell color order system. Unfortunately, he was ignored by dental schools and therefore by dentists. By 1973 he was almost a total recluse because of this rejection. I was told that he would see no one, but because my father had graduated from dental school with Bruce in 1918, I was invited to Bruce's home for a memorable weekend in 1973. To sit and exchange ideas with this living legend was an experience to be savored!

Color control had a long and rocky journey, and though in the scientific and commercial world there had been magnificent progress, dentistry was mired in the past. In an address to the 108th Annual Session of the American Dental Association in 1967, I pointed out that solely the dental manufacturers controlled the color of dental products and that the dentists had to accept what was offered. Research on the color control of breakfast food boxes was

apparently more important than the color control of prosthetic devices for patients. Educators placed more emphasis on teaching color concepts to the amateur artist than in instructing the dental student, the dentist, and the dental technician about the importance of understanding color. Accordingly, it seemed that it was not important that dentists be given the correct definition of the dimensions of color.

I was floundering in trying to understand why a correct color match was so difficult as I taught interns and residents in 1966. I would sometimes consider hiding when it came time to pick the shade of a student's patient.

The breakthrough came when the Munsell hue, value, and chroma became my companion! About this time a dental manufacturer came out with a booklet on how to pick and adjust the color of a restoration based on the evaluation of the dimension of color. Bruce's articles had been located, and I was certain that the Munsell system was the answer, but in trying to follow the booklet, I would get hopelessly lost because two of their definitions described the same dimension. When I pointed out the error, they refused to correct it; they had too much money invested in the glossy booklet. In the meantime the other manufacturers jumped on the bandwagon with the incorrect definitions.

Color measurement of natural enamel and restorative materials is essential in both dental research and clinical practice. Such measurements were routine in the automobile and paint industries and even for products such as breakfast food boxes in the 1960s. Henry Hemmendinger showed me the first spectrophotometric curve of natural enamel I had ever seen. Told that the target was too small to get a reading, Henry took the tooth I gave him, placed it in the target holder of his G.E. spectrophotometer, took a cardboard and punched a hole in it with a sharp pencil, put the cardboard in front of the light source to collimate the beam, and—voila—the curve of natural enamel! Henry went on to run thousands of curves for me, other dentists, and manufacturers of dental porcelain.

Today it is possible to use instrumentation to choose the correct color match, but it is important to remember that the final acceptance/rejection is almost always the one based on the observer's response. The importance of being able to compare colors and accurately evaluate and describe differences would seem to make an understanding of color as important today as it was for me in the 1960s and to Bruce Clark in the 1920s and 30s. A famous quote from one of Bruce's articles says it all: "In the study of color not only is an intimate acquaintance with its three dimensions the first requisite that should be acquired, but it is, without a single exception, the most important."

My adventure in color was most rewarding. It resulted in friendships too numerous to mention. It brought pleasure in an area that was a bewildering nightmare. Bruce and I agreed on most things on that memorable

visit, but he felt tracking down his 703 porcelain tabs was unimportant. They are supposed to be at the Chicago Museum of Science and Industry, but Charley DuFort and I were unable to locate them on several occasions. I am convinced that they are a dental treasure that should be located and displayed in tribute to E. Bruce Clark!

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Preface

This book and a color training program on the supplementary CD-ROM are very different from learning resources on color matching, communication, and reproduction in dentistry that you may have read in the past. The scope of the book and CD-ROM is to provide both educational and training tools for achieving lifelike color and appearance, which are probably the most important parameters of esthetics in dentistry. The material offered is intended for future and practicing dentists and dental technicians as well as dental educators and researchers. Less experienced users will benefit from facilitating a good start in esthetic dentistry, whereas more experienced users will benefit from the opportunity to reconsider and adjust their approach and strategies in color matching, communication, and reproduction.

Part I of the book consists of three chapters, providing basics of color and colorimetry as well as other appearance attributes. This part emphasizes topics and principles essential for further understanding and mastering a plan for successful work with color in both the dental office and dental laboratory. Theoretical information on color and appearance makes this part of the book particularly beneficial for researchers and educators.

Part II provides information on color and appearance of natural teeth as well as a variety of contemporary esthetic dental materials given in two separate chapters. Our target is to match the optical properties of natural teeth: The better the match, the better our chances for success. The same is true for esthetic dental materials. We would probably want to know which resin composite exhibits minimal color changes upon curing or aging as well as we want to identify the most efficient bleaching agent.

The first chapter in Part III describes some specific issues regarding color vision, education in color and appearance, and color training in dentistry. The second chapter offers a phase-by-phase description of a visual color matching method and a review on instruments for shade matching and color formulation in dentistry. The tips, strategies, and physiology that lead to accurate matching of color and appearance are presented in this chapter. The next chapter describes a wide range of color and appearance communication tools, emphasizing the most advanced method using digitalized

images. The last chapter of this part describes reproduction of color and appearance of indirect and direct dental restorative materials as well as in-office color corrections. How to avoid the most common problems associated with reproduction of color and appearance is explained, and examples and practical suggestions are provided.

Part IV provides information about the CD-ROM, an interactive color training program. Included are program installation, a description of the program, and color training method. The program enables systematic step-by-step color training. Along with facilitating familiarity with color dimensions, the program offers seven groups of color matching exercises—three introductory, three training, and one advanced. Exercises are designed within the extended color range of natural teeth. In each set, exercises range progressively from the simplest to the most difficult. The exercises can be performed using the user-friendly drag and drop method, and instant feedback is provided. After any exercise is completed, information on the first score and the best score is displayed on the screen. At any time, the user can access the table containing all the scores obtained with or without a time limit.

Some chapters include advanced content, such as a new CIEDE2000 computation, color formulation issues, and additional considerations on digital imaging. These advanced content sections appear at the end of each relevant chapter.

This book challenges several long-held doctrines regarding dental shade guides and visual color matching methods by identifying shortcomings and proposing new and specific solutions and techniques. However, there is no final and ultimate truth in either dental practice or science—new dental materials and techniques as well as new research findings will certainly enrich future editions of this book. We anticipate that time with excitement.

Visual assessment is the ultimate parameter in a patient's acceptance or rejection of a dental restoration. However, the paradox of esthetic dentistry is that our best work is the restoration that no one will notice (a natural, not artificial appearance). We link this observation to the famous sentence from Antoine de Saint-Exupéry's *The Little Prince*: "It is only with the heart that one can see rightly; what is essential is invisible to the eye."

Rade D. Paravina
John M. Powers

Contents