ORIGINAL RESEARCH

Standardization of Colour Grading for Gross Specimen amongst Oral Pathology Residents: An Inter Institutional Study

Sangamithra S, Prathiba Ramani, Abilasha R

Abstract

Background: Histopathological diagnosis is considered as the gold standard for diagnosis of pathological conditions. The first and the most important step in histopathological diagnosis is grossing. Identifying and describing the specimen is paramount as it has direct implications on the final diagnosis. One of the steps in grossing is describing the color of the specimen. Oral specimens come in an array of colors and provide a significant insight into the nature of the specimen. Currently, there is no standardized technique for description of color. There is a high degree of inter observer discrepancy.

Aim: The aim of the study is to standardize color description of gross specimens among training post graduates.

Materials and Methods: Two different color palettes were created. 30 oral pathology residents from 3 institutions were included for the study. 5 simple specimens were used. The oral pathology residents were asked to write down the color of each specimen in the conventional manner and then write using the color palette(s).

Results and Conclusion: Intraclass correlation coefficient showed statistical significance between the variables. This infers that there is substantial decrease in inter observer discrepancy.In this study, we have made the first attempt to standardize color description during grossing of pathological specimens. More studies with larger samples are needed to evaluate this method's global performance.

Keywords: Pathology, specimen, grossing, colour standardisation, innovation

Introduction

Oral and Maxillofacial Pathologists deal with numerous tissue specimens on a daily basis. Proper grossing of specimens is crucial as this forms the foundation of further histopathological examination. One of the major components of grossing is the description of color of the specimen. Although most of the specimens received are of similar color, some specimens impart a unique color which will be helpful in the diagnosis of the disease. Pathologists, more than any other physicians, should be aware of the importance in recognizing normal and abnormal gross organ features, color being one of them, that translate into specific pathologic processes. Because cells are microscopic and colorless as single units, they result in a given color only when they accumulate in millions[1]. Unhealthy and/or neoplastic tissues usually retain the color of the cells from which they derive but may also exhibit completely different color characteristics. Exact description of the gross color of the specimen is of utmost importance as it can help in accurate diagnosis of the disease[2,3].

Colors are important to all biologic organisms, that is, microorganisms, plants, and animals, because they are crucial for camouflage and protection, metabolism, sexual behavior, and communication. In general, coloration of organisms results from the production of molecules derived from cyclic compounds[4]. Endogenous colors are the result of complex biochemical reactions that produce biological pigment.Red-brown cytochromes and porphyrins are seen in blood, liver, spleen, kidneys and striated muscle[5,6]. Brown-black melanins are seen in skin, appendages and brain nuclei. Dark-brown lipochromes are seen in aging organs, and colors that result from tissue structure such as in tendons, aponeurosis and muscles[7]. Yellow-orange carotenes that deposit in lipid-rich

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tissues are only produced by plants and are acquired from the diet[8]. These colors hence can provide a unique additional feature to the specimens.

Till date, there is no standardization of the color description of specimens during grossing and is done purely on a subjective basis.

In this study, we have made the first attempt to standardize color description during grossing of pathological specimens. The aim of the study is to standardize color description of gross specimens among training post graduates. The rationale behind this study is that providing a common color palette depicting the various colors of the specimens received, will ensure uniform description of color during grossing and will reduce inter-observer discrepancies.

Materials and Methods

This is an inter-institutional blinded cross-sectional study. Oral pathology residents were included for the study. Simple and non complex specimens were included. Large complex specimens were excluded due to the presence of numerous degrees of color variation. Two different color palettes were created and patented (No: 202241008885). One palette consists of monochrome colors and its shades(Fig 1). The second palette consists of bicolor shades(Fig 2). This palette should be used as a reference for the description of the color of the specimen.

Color palette 1 is made of single color tiles and their shades which are numbered A1 to H5. The alphabets A to H depict the hue value and the numbers 1 to 5 depict the value of each shade. Color palette 2 is made of bicolored tiles and are numbered U1 to Z5. The bicolored palette is made based on the most commonly seen color combinations in specimens received in regular practice. The color palettes should be placed beside the specimen under natural light and the color is selected based on visual comparison of the shade in the palette and the specimen. Then the corresponding code should be noted. To analyze the efficacy of these color palettes, an inter-institutional study was performed. 30 oral pathology oral pathology residents from 3 institutions were included for the study. 5 simple specimens were used. The oral pathology residents were asked to write down the color of each specimen in the conventional manner and then write using the color palette(s). The order of the specimens were blinded to the participant and a scoring paper was given (Fig 3). The scoring of the colors were as follows: 0 - Wrong, 1 - Partially correct, 2 - Correct. Intraclass correlation coefficient was done.

Results

Intraclass correlation coefficient showed statistical significance between the variables (Table 1). This infers that

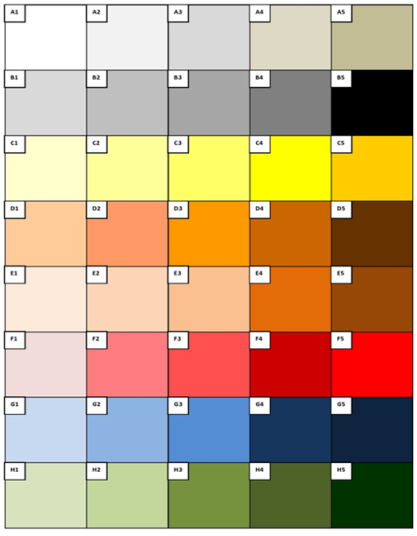

Fig. 1: Color palette guide 1

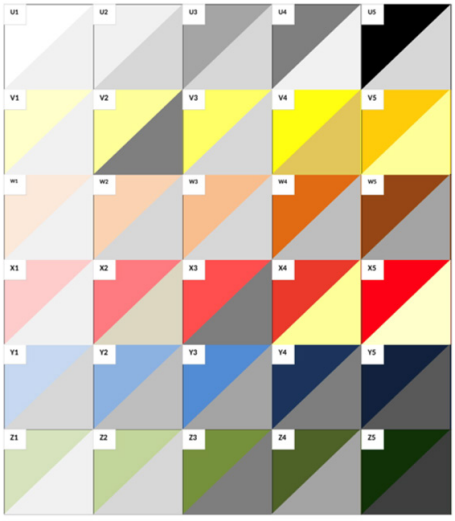

Fig. 2: Color palette guide 2

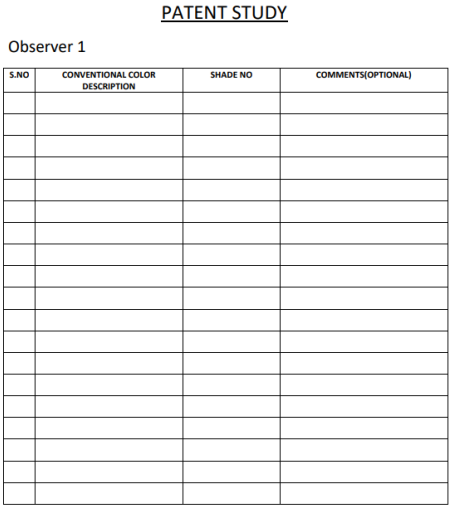

Fig. 3: Scoring paper used for comparing color description

Table 1: Intraclass coefficient analysis of variables

	Intraclass Correlation	95% Confidence Interval		F Test with True value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.263	.092	.762	11.688	4	116	.000
Average Measures	.914	.752	.990	11.688	4	116	.000

there is substantial decrease in inter observer discrepancy. Oral pathology residents were more comfortable in using color palette 1, i.e, the monochrome color palette compared to the bicolored one. With the monochrome color palette, they were able to identify more than 2 shades of color in the same specimen, which directly contradicts the conventional color description, wherein a maximum of two colors are described.

Discussion

The first and the most important step in histopathological diagnosis is grossing. Identifying and describing the specimen is paramount as it has direct implications on the final diagnosis. One of the steps in grossing is describing the color of the specimen. Oral specimens come in an array of colors and provide a significant insight into the nature of the specimen. Colors are illustrative to all biological organisms such as microorganisms, plants, fungi and animals because they are pivotal for camouflage, protection, metabolism and communication[9,10]. In general, organisms' coloration is caused by the production of molecules derived from cyclic compounds[9,11].

The human body and its organs have colors, such as the liver, which is brown, the heart, which is red, the bones, which are white, and so on[4,12]. Although this is obvious and well-established, the reason for the color of organs is not fully understood.

More than any other type of clinician, pathologists should be aware of the significance of distinguishing between normal and aberrant gross organ traits, one of which is color, that correspond to certain pathologic processes[5].

Currently, there is no standardized technique for description of color. There is a high degree of inter observer discrepancy. This has potentially decreased the overall quality of the grossing procedure. In this study, we have created a standardized color palette for description of color and have evaluated its efficiency.

We found out that there was a significant decrease in the interobserver discrepancy. This could be attributed to the fact that the oral pathology residents had a chance to compare the color of the specimen to a standard color palette and then describe. This means that very few options are left to the imagination of the student and direct observational results are provided. One other interesting whilst being an important observation was that, among the two color palettes, students felt more comfortable using the single shade color palette. Using that, they were able to mention more than two colors in a single specimen. This is directly against the conventional color description, where only one or maximum of two colors are described. This goes to show that oral pathology residents are capable of distinguishing multiple colors from a single specimen.

Color description is one of the most vital descriptions during grossing as it involves understanding the underlying pathology[4]. One of the minerals that is most frequently found in the body and gives teeth and bones their white color is calcium. If protoporphyrin levels are unusually high, as they are in the extremely rare porphyrias, human bones or teeth will turn pink or brown[13,14]. Bone matrix- or enamel matrix-producing tumors, such as osteoid osteomas, osteoblastomas, osteoid-producing osteosarcomas, and odontomas, are white, particularly in areas with CaPO4 matrix deposition, just like normal bone and enamel[15,16]. Benign and malignant proliferation of fibroblasts, smooth muscle, or stromal cells that produce type I collagen are usually white, such as old scars, leiomyomas, and several sarcomas[17,18]. However, the amount of blood vessels, fat, mitochondria, and cytochromes may affect the color of these white lesions. Areas of so-called dedifferentiation in low-grade sarcomas are typically white in color. High-grade sarcomas, desmoplastic small blue round cell tumors, and dendritic cell sarcomas are white[19]. Interestingly, for unknown reasons, gastrointestinal stromal tumors are pink or light brown[20]. Both benign and malignant cartilage neoplasms (enchondromas or chondrosarcomas) retain the cartilage matrix's translucent or bluish coloring[21].

Every epithelium is avascular, intrinsically white, and melanin-pigmented-free. Patients with albinism, who have red irides in addition to white skin and hair, can be seen in this situation.[22–25] Additionally, both benign and malignant epithelial proliferations, including oral leukoplakias, keratoses, epidermal inclusion cysts, and dermoid cyst contents, can exhibit the intrinsic white color of epithelia[26–30]. Age-related accumulation of lipofuscin, a pigment made from oxidized lipids, occurs primarily in the heart, liver, retina, and brain[31–33]. Melanosis coli, a condition in which significant amounts of lipofuscin rather than melanin are deposited in the colorectal mucosa, is the best way to appreciate the dark-brown hue of lipofuscin[34–37]. Additionally, lipofuscin deposits contribute to the rare condition known as "black thyroid," which develops in some people after using minocycline[38]. Depending on the ratio of lipids, cholesterol, and bile pigments, gallstones can be yellow, brown, yellow-green, or even black in color[39]. High levels of bile can cause hepatic adenomas or hepatocellular carcinomas to turn yellow-green or green-brown[40]. The conversion of hemoglobin to deoxygenated hemoglobin, heme catabolism to iron and protoporphyrin, and production of biliverdin and bilirubin, in that order, account for the progression of colors seen in bruises, hemorrhages, or hematomas from red to purple-blue, black, green, and yellow[41].

With all these taken into consideration, it is high time we reconsider changing the color description during grossing.

Conclusion

We now appreciate the importance of color description in grossing. The oral tissue is composed of a complex composition of components and each component imparts a unique color based on their molecular changes. It is the duty of the pathologist to understand the intricacy of these changes and apply in their routine practice.

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