

Dental Material

Optical properties

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Optical properties

Introduction

Color: The perception of color is the result of a physiological response to a physical stimulus.

Of all the visible colors and shades, there are only three primary colors: **red, green, and blue** (or violet). Any other color may be produced by the proper combination of these colors. For example, yellow light is a mixture of green and red lights.

One of the most commonly used method to define and measure color is the **Munsell System**.

Munsell System (Dimensions of color)

The three dimensions of color are: hue, chroma and value.

Hue: it is the basic color of an object (red, green or blue).

- The Hue of an object is determined by the wavelength of the light. The place of that wavelength in the spectrum determines the Hue of the color. The shorter the wavelength, the closer the Hue will be to the violet portion of the spectrum; the longer the wavelength, the closer it will be to the red portion.

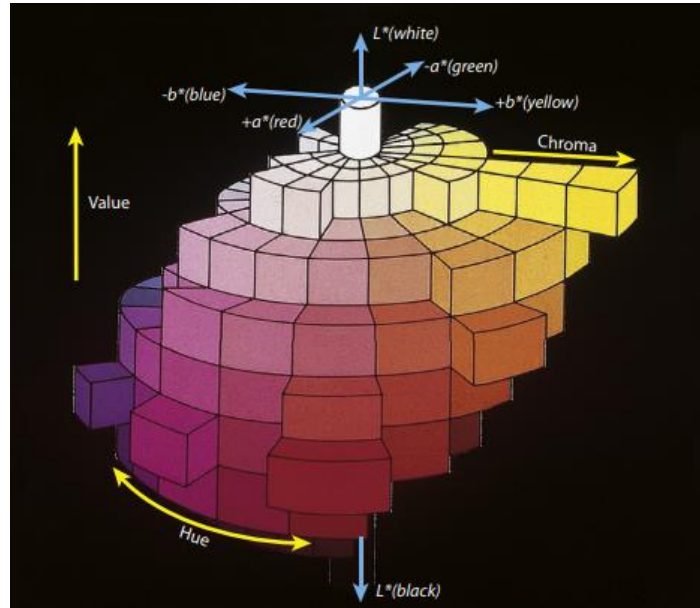
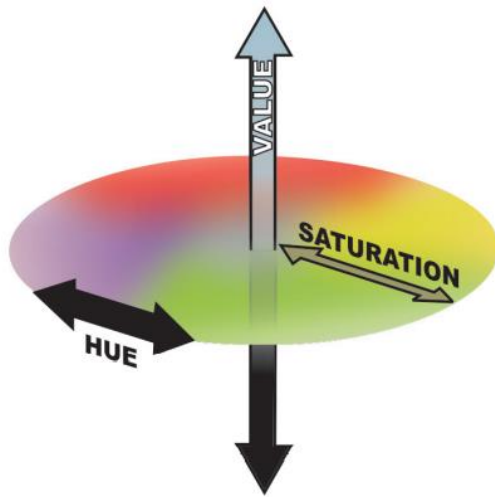


Chroma: it is the intensity or strength of hue (the higher the chroma, the more intense is the color). For example: a red and pink may be of the same hue. The red has a high chroma, while the pink has a low chroma.



Value: the amount of lightness or darkness in the color.



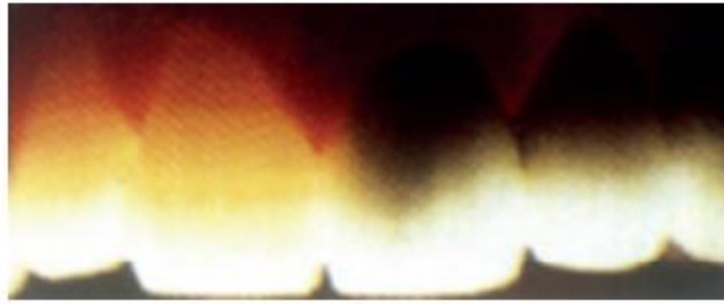


Opacity, Translucency and Transparency

Opacity is a property of materials that prevents the passage of light.

- When all of the colors of the spectrum from a white light source such as sunlight are reflected from an object, the object appears white.
- When all the spectrum colors are absorbed equally, the object appears black.
- For example, If red, orange, yellow, blue, and violet are absorbed, the material appears green in reflected white light.

Translucency: is a property of substances that permits the passage of light but disperses the light, so objects cannot be seen through the material. Some translucent materials used in dentistry are ceramics, resin composites, and denture plastics.



Poor translucency exhibited by the metal-ceramic restoration on the right when compared to the natural teeth

Transparency: is a property of substances that allow the passage of light and objects may be clearly seen through them such as glass.

- For example, if a piece of glass absorbed all wavelengths except red, it would appear red.



Perception of color

Shade selection is very subjective and different individuals will have different interpretations of the same stimulus.

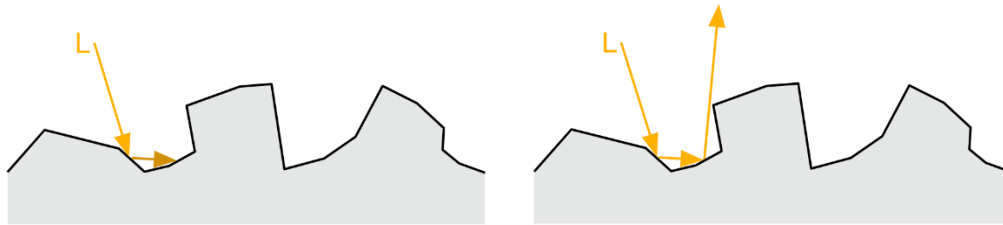
Color depends on three factors:

1. The observer.
2. The object.
3. The light source.

Note: There are three light sources commonly found in the dental office: natural, incandescent, and fluorescent.

Surface Finish and Thickness

- Extremely rough surface appears lighter than a smooth surface of the same material because when white light shines on a solid, some of the light is directly reflected from the surface and remains white light. This light mixes with the light reflected from the body of the material.



- The thickness of a restoration can affect its appearance: opacity increases when the thickness of the restoration increases.

