

2025-2024

Physical properties of dental material (Electrical properties)

Tarnish:

Tarnish is a surface discoloration on a metal or even a slight loss or alteration of the surface finish or luster.

Tarnish generally occurs in the oral cavity due to:

1. Formation of hard and soft deposits on the surface of the restoration, e.g. calculus, mucin and plaque.
2. Pigment producing bacteria will produce stains.
3. Formation of thin films of oxides, sulfides or chlorides.



Corrosion:

It is the deterioration of metals by chemical interaction with their environment.

Corrosion can be classified as:

1. Chemical or dry corrosion.
2. Electrochemical or wet or electrolytic corrosion.

Chemical or Dry Corrosion: The metal reacts to form oxides and sulfides in the absence of water or other fluid electrolytes.

Example: Oxidation of alloy particles in dental amalgam.



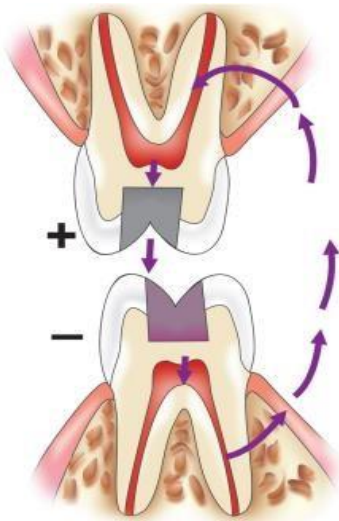
Electrochemical or Wet or Electrolytic Corrosion: It is the loss of electrons by a metal in the presence of water or other fluid electrolytes

Types of electrochemical corrosion

1-Galvanic Corrosion

Galvanic corrosion occurs when dissimilar metals lie in direct physical contact with each other.

e.g., If a gold restoration comes in contact with an amalgam restoration, the amalgam oxidize and starts corroding.



Potential galvanic current pathway when dissimilar metals contact. The tissue fluid and saliva behaves like an electrolyte.



2-Heterogeneous compositions

This kind of corrosion occurs within the structure of the restoration itself. Impurities in any alloy enhance corrosion.

3-Stress Corrosion

A metal which has been stressed by cold working, becomes more reactive at the site of maximum stress.

e.g., if a wire has been cold worked, stress corrosion may occur and cause the wire to break.



Factors affecting corrosion of restorations in the mouth

1. Diet
2. Drug
3. Smoking
4. Bacterial activity
5. Oral hygiene and habits.

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Physical properties of solid material (Optical properties)

Optical properties

The eye is sensitive to wavelengths from approximately 400 nm (violet) to 700 nm (dark red).

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.

Dimensions of Color

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

Munsell System (Dimensions of color) :

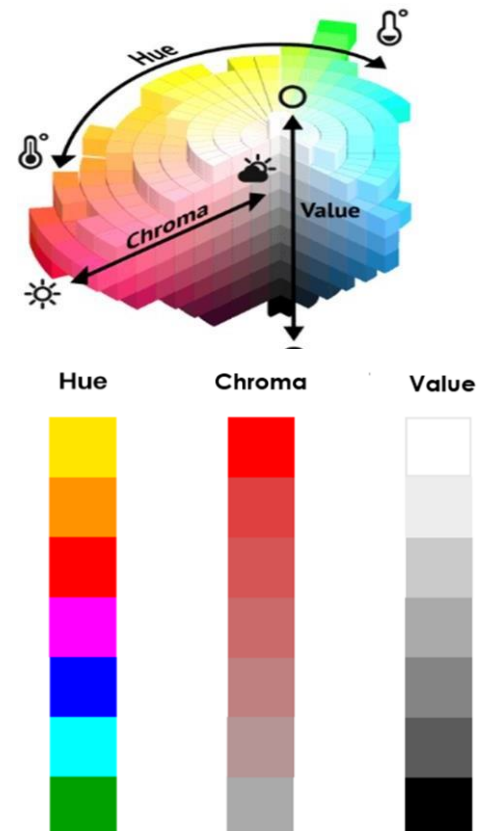
The three dimensions of color are: *hue, chroma and value*.

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

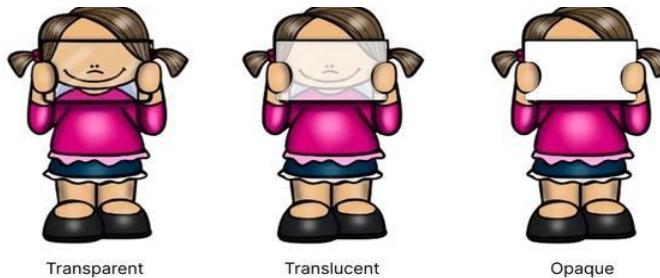
Opacity: is a property of materials that prevents the passage of light.

- 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.

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.



Tooth esthetics

Reproducing a tooth—both art and science. The esthetics of a dental restoration is determined by

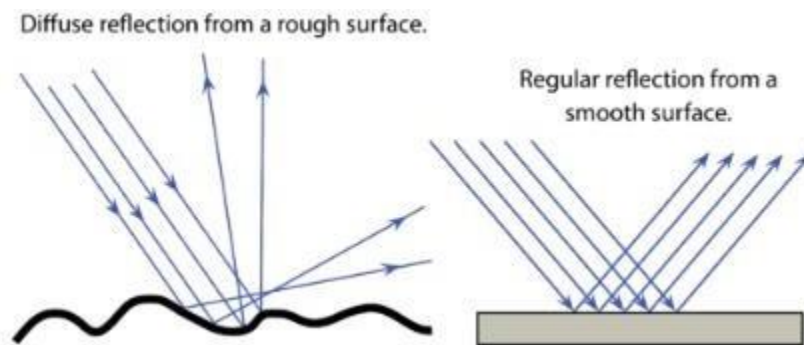
1. Shape
2. Color
3. Texture

Perception of color

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 increase.