Shade selection (matching) in fixed prosthodontics

Lecture 9

Prepared By :

Dr Maitham Yahya Altufaili

Board Speciality (MSc) In Restorative Dentistry

dr_maitham_altufaili

@DR.MAITHAM_ALTUFAILI

University of Hilla
Dentistry college

Restorative department

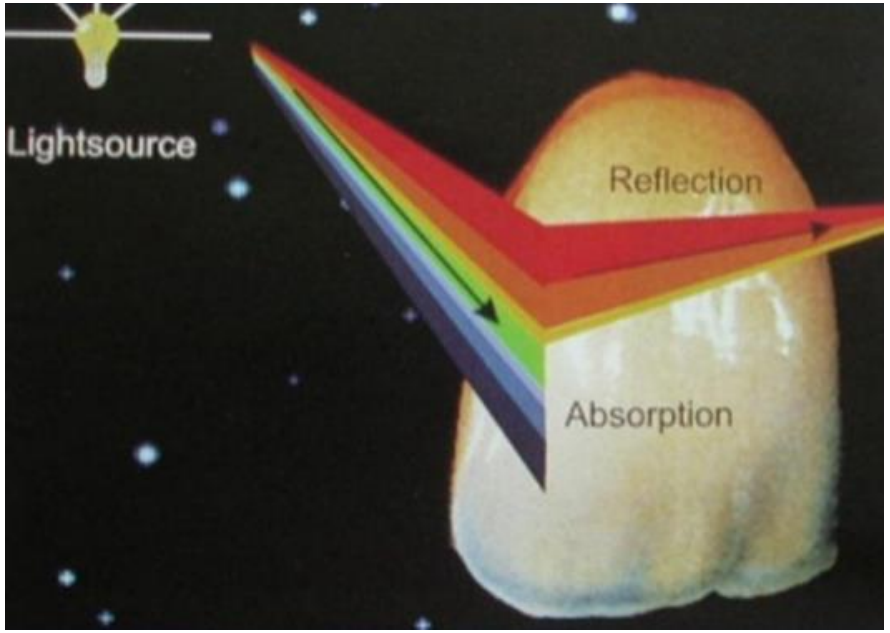
25-12-2025

Fifth stage

Matching two objects that reflect similar color (wavelengths of electromagnetic spectrum)

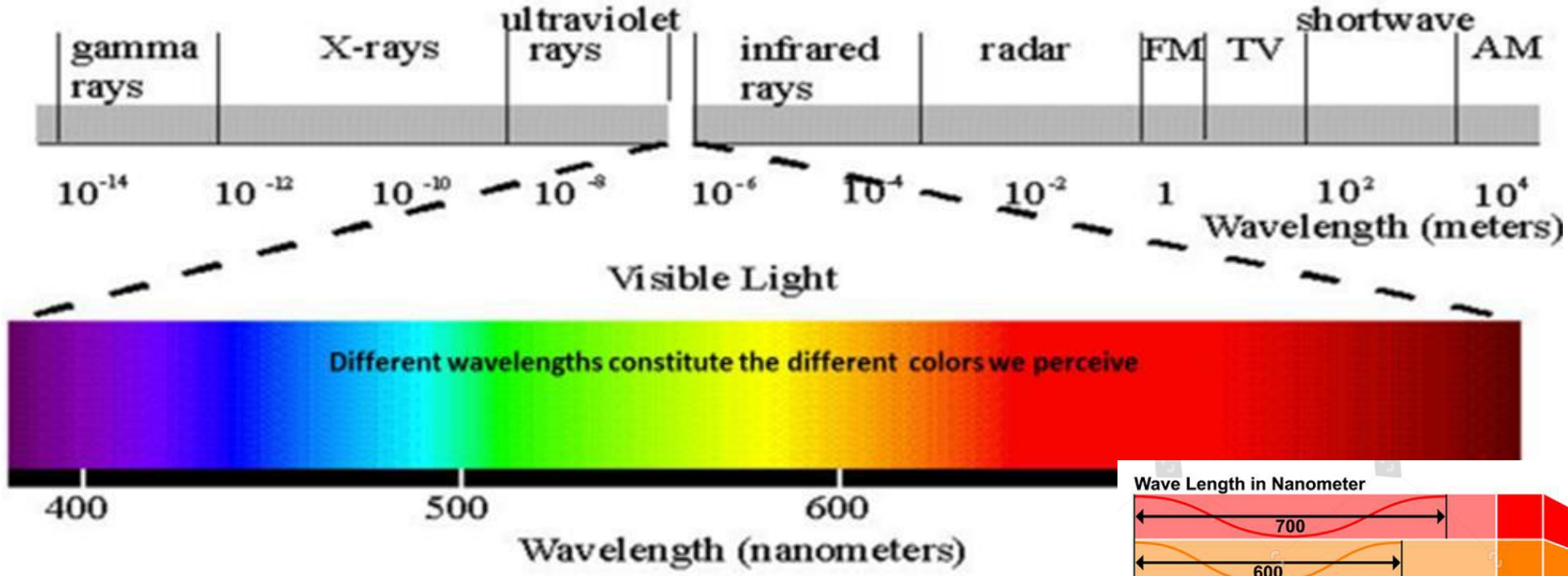
Shade Selection in Fixed Prosthodontics:

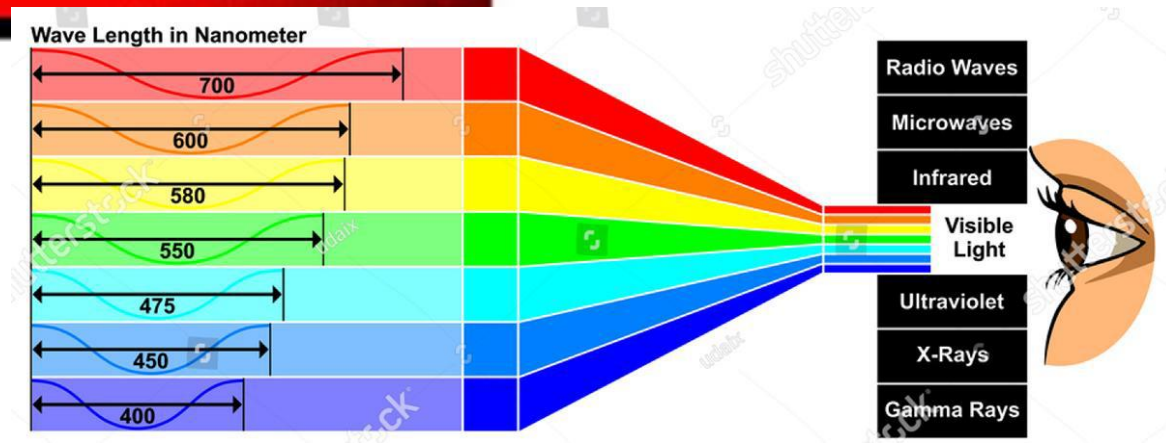
- ✓ Process of replicating the color of the adjacent teeth in a prosthesis.
- ✓ The success of dental treatments as perceived by our patients is often evaluated on appearance, rather than long-term health, function and comfort.
- ✓ Color that is the result of a light source, *the object that* ***absorbs, transmits, reflects or scatters*** *the light from the source*, and the interpretation of the result by the human visual system.
- ✓ Without Light; Color Does Not Exist
- ✓ The color of an object is determined by the **reflected** light that enters the human eye from that object



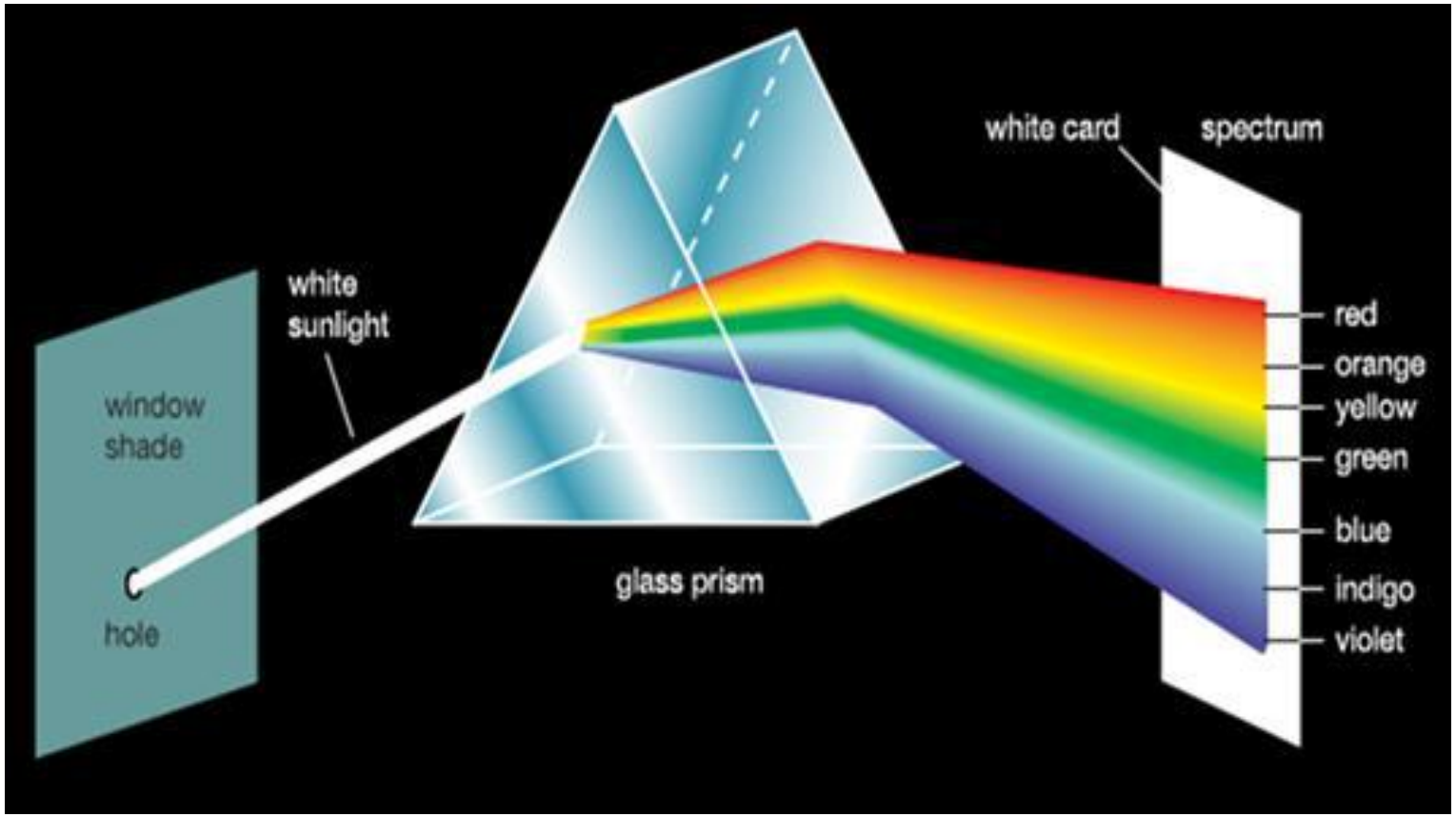
What is light?

- **Light** is a Form of visible energy that is part of **the radiant energy spectrum**.
- The eye is only sensitive to the **visible portion of the spectrum (380 – 750nm).**



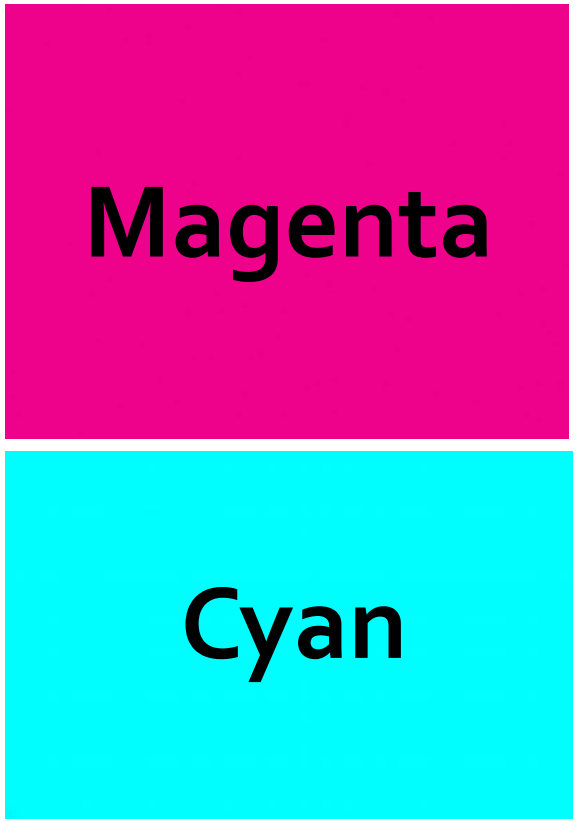


- When Pure White Light passes through a prism we see component colors of white light, Shorter wavelengths bend more than longer wavelengths

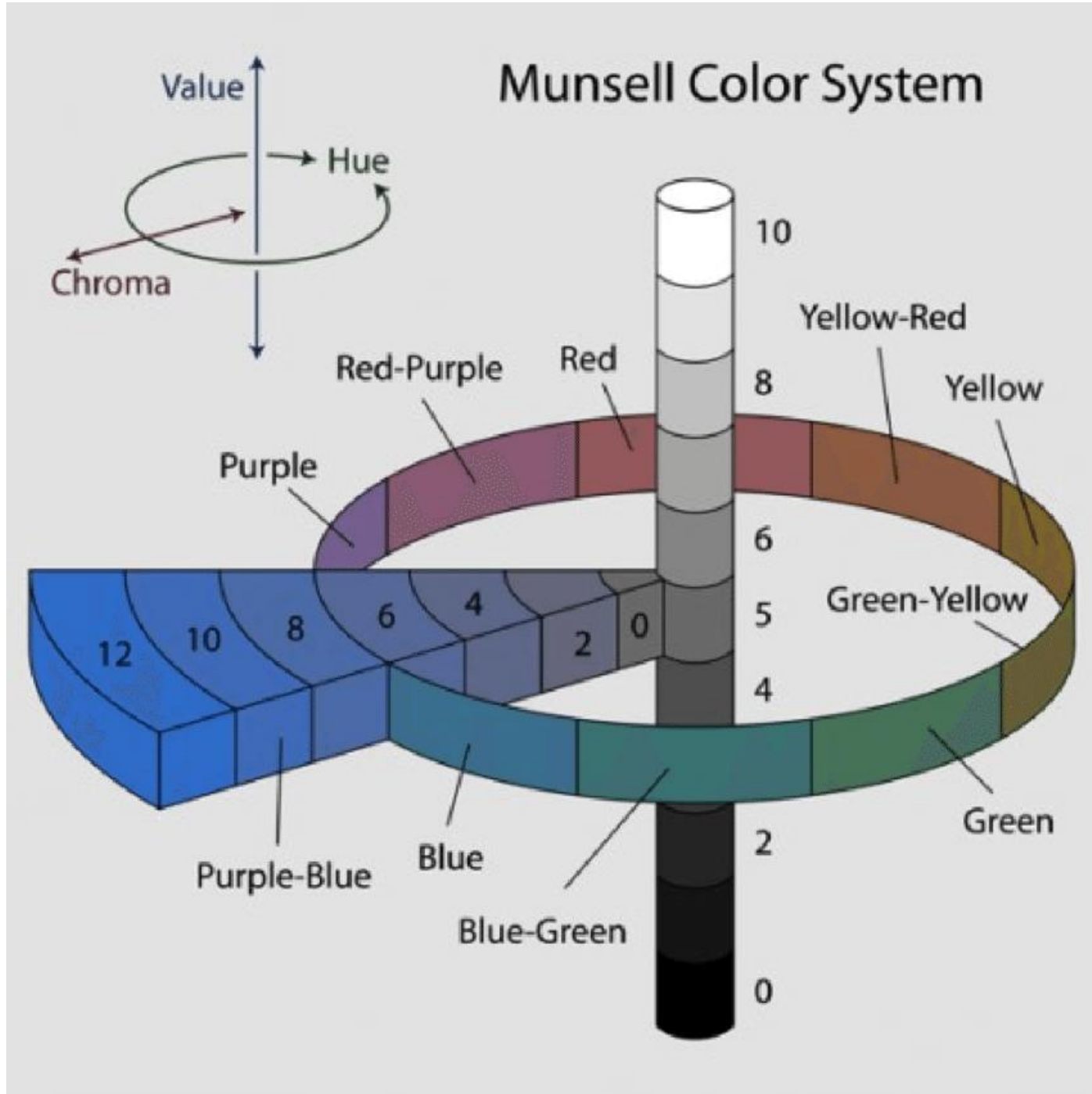


Color Mixture

- **Primary colors**
  - Red, green, blue
- **Additive mixture system-**
  - Mixing two of the primary colors produces a new color
  - Red + blue = magenta
  - Red + green = yellow
  - Green + blue = cyan
- **Pigment mixture system**
  - Yellow, cyan, magenta



- **How To Describe Color In Words**
- Albert Munsell, felt a need to describe the colors of his drawing in definite terms to his students. This led to the development of the **Munsell Color System**, a widely used visual color order system**.**
- He described **three dimensions** of color **hue, chroma, and value**.
- It is possible to vary each of these qualities without disturbing the other.
- The ability to understand each of these dimensions and separate them from one another is fundamental to an understanding of color as it relates to dentistry


Munsell Color System
Value
Hue
Chroma
10
8
6
5
4
2
0
Red-Purple
Red
Yellow-Red
Yellow
Purple
Green-Yellow
Green
Purple-Blue
Blue
Blue-Green
12
10
8
6
4
2
0

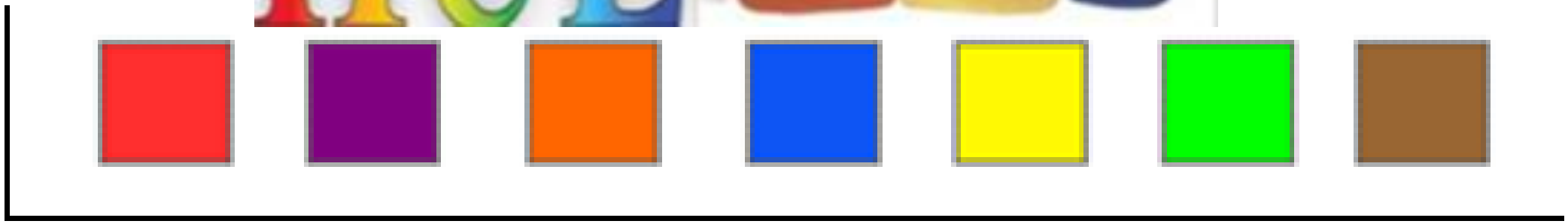
- Munsell defines three dimensions of colour:
- **1. Hue**
- Quality by which we **distinguish one colour family from another** (variety of colours).
- **We have ten hue colour families which are:**

1. R-red 2.YR-yellow-green 3. Y-yellow 4. GY-green yellow 5. G-green 6.BG-blue green

7. B-blue 8. PB-purple blue 9. P-purple 10.RP-red-purple.

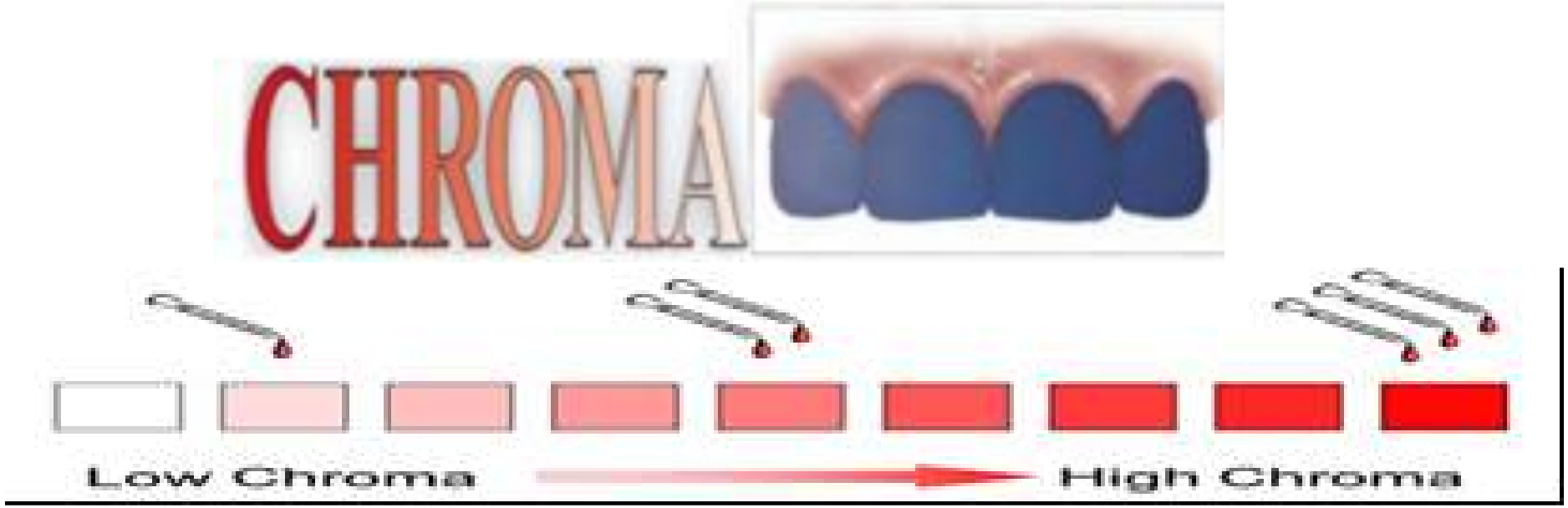
- Each of these ten hues is further subdivided into ten numbered segments.





2. Chroma

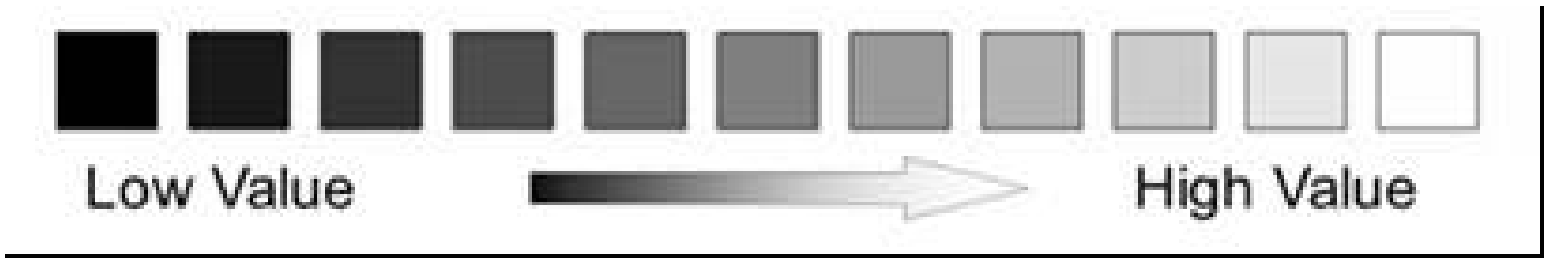
- Quality of color by distinguishing **a strong color from a weak one (the intensity or saturation of hue)**.
- The degree of departure of a color sensation from that of white or gray; the intensity of a distinctive hue, **color intensity _Range= 0 – 12**



3. Value

- Quality by which we **distinguish a light color from a dark one or the relative brightness of an object (lightness or darkness),** ranges from zero to ten, black is zero(0) and white is ten (10).
- The value of a color is determined by which one of the grays it matches on the scale.
- Colors with low-value numbers are termed dark colors, and ones with high-value numbers are called light colors. A black-and-white television tube emits only a range of values 9.







- **Factors that influence the apparent color of an object (teeth):**

1) Nature of light

- We have three light sources **Incandescent Light, Fluorescent Light and Natural Daylight**.
- Most dental offices are outfitted with **incandescent and fluorescent lights**.
- Incandescent Light Emits a high concentration of **yellow waves** matching.
- While Fluorescent Light Emits a high concentration of **blue waves.**

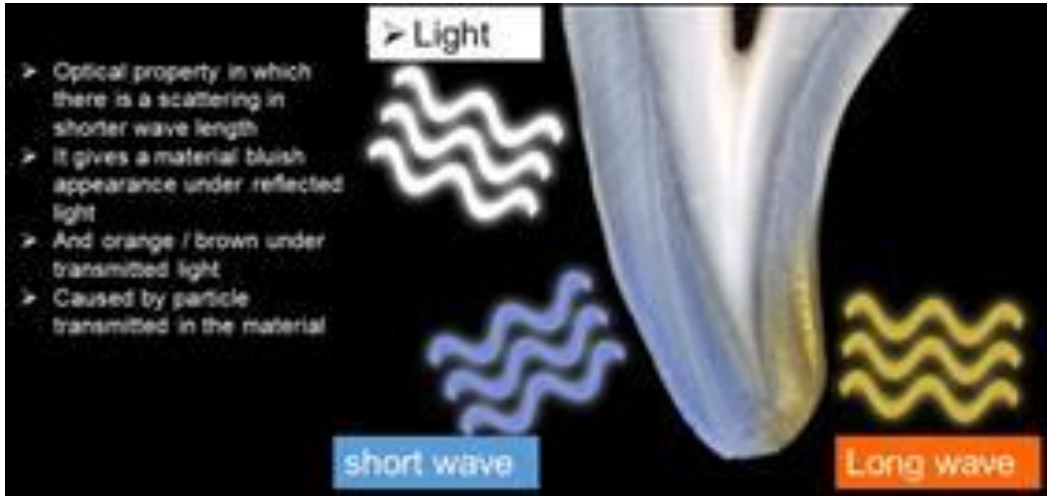


- Both of these are not suitable for shade matching. Chair light is not recommended for colour matching as it is overpowering and interferes with fine discrimination of three dimensions of colour
- **Natural Daylight** is considered **the best Closest to emitting the full spectrum of white light** Used as the standard by which to judge other light sources.
- In the Morning and evening light spectrum is rich in yellow/orange and lacks blue/green because shorter wavelengths scatter before penetrating the atmosphere, **Mid-day time** (Hours around noon) when a Full spectrum of colors is visible **considered the ideal time for color matching.**

2) Physical properties of the object:

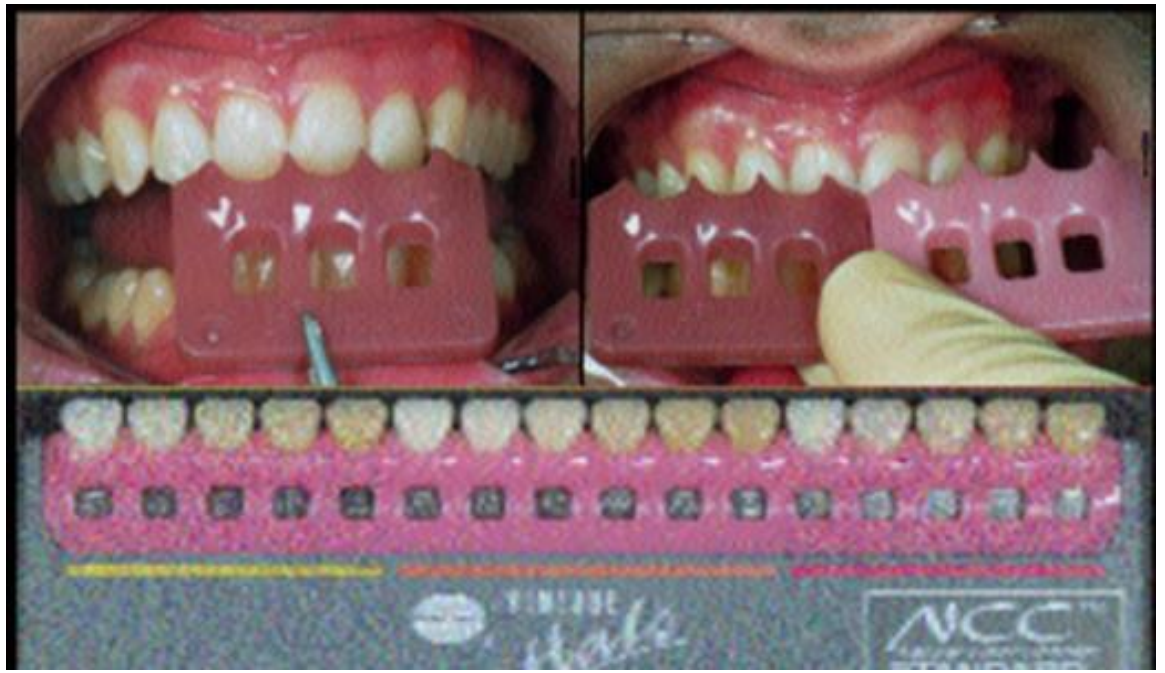
- When light strikes an object, and according to the physical properties some wavelengths are **absorbed** by the object, while **others transfer** throw it, the remaining are **reflected**, the color of an object – light that is reflected by the object.
- True color characteristics and appearance of depth translucency in a natural tooth cannot be correctly perceived unless the tooth is free of plaque and surface stains.
- With increasing opacity of teeth, the grayscale value decreases and the brightness (value) increases, **The Higher the brightness (values) the lower the transparency** becomes.
- The **more transparent a tooth the more gray it appears.**

- **Opal Effect (Opalescence):**
- Fine particles in enamel (hydroxyapatite crystals) are responsible for the opal effect.
- Fine particles reflect **short wavelengths** and allow longer wavelengths to pass through.
- Hence areas within a tooth or a restoration with higher translucency will have a lower value because light transilluminates through and away from the viewer.
- When evaluating enamel translucency, the observer will often focus on the opalescent blue areas which is why **Translucent areas of the teeth appear grey;** while the **opaque incisal edge appears white.**
- Hence tooth shows
  - **Bluish areas in reflected light**
  - **Orange red areas in transmitted areas**





- Tooth must be kept moist during shade selection. The color environment surrounding an object influences our color perception of the tooth significantly (gum, lip color and color behind the object).
- **The Gumy gingival mask** (color contractor) was developed to neutralize the influence of the color environment on our color perception during visual shade selection.

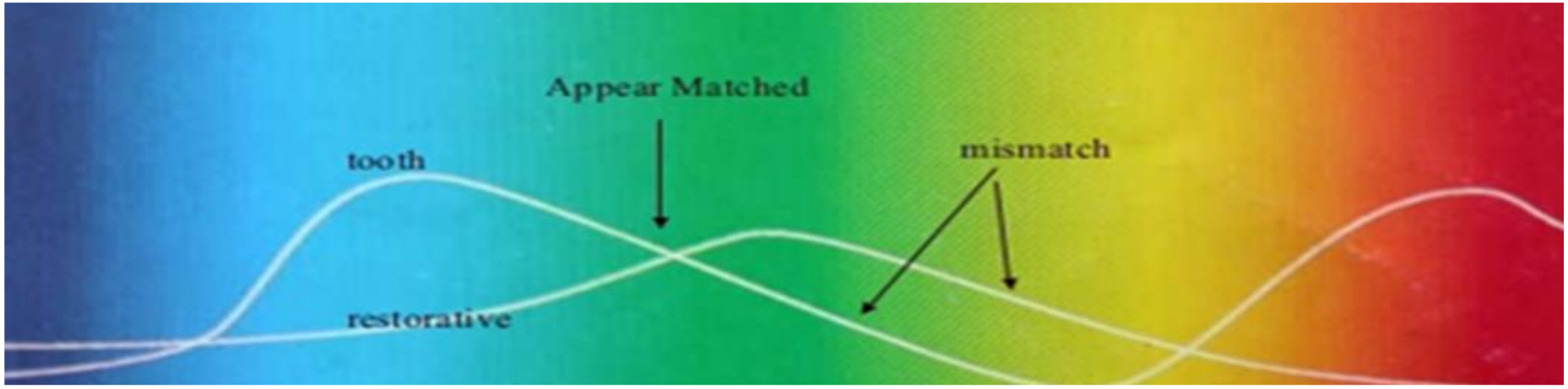


Metemerism

- Phenomenon occurring when the color of the **two objects** appears to match under **one lighting source** but not under a different source.

Clinical significance of Metemerism

- Tooth & crown restorative material of a differing shade may appear matched under certain light conditions, but may show a discrepancy in daylight, that is why, shade selection must be evaluated under multiple light sources (different light sources)



3) Subjective assessment of the observer

- The light first penetrates a layer of nerve fibers, then passes through several layers of cells, and finally reaches the rods and cones, which are embedded underneath.
- The rods and cones of the retina form the chief component of the retinal receptor complex.
- The rods detect only lightness and darkness (value).
- The cones perceive the chromatic aspects of an object (hue and chroma).
- **Achromatism** – complete lack of hue sensitivity.
- **Dichromatism** – sensitivity to two primary hues.
- **Anomalous Trichromatism** – sensitivity to all three hues, with abnormality in retinal cones affecting one of primary pigments.
- ***If any deficiency is detected, a dentist should seek assistance when selecting tooth shades.***

- **Shade Selection Methods**
- Traditional shade-taking involves matching one or more selected colors from a range of shade tabs to the teeth adjacent or contralateral to the teeth to be restored.

1) Visual shade matching.

- Visual shade selection by comparison of a patient's tooth with a color standard (i.e. commercially available shade guide) .
- **A Dental Shade Guide** is a set of simulated teeth used to select prosthetic teeth by color.
- Shade guides are Examples of various color combinations available from manufacturers of denture teeth, restorative resins and porcelains.
- **The most commonly use shade guide in fixed prosthodontics:**
  - a) Vita Classic Shade Guide
  - b) Vita-3D –Master shade guide
  - c) VITA Linearguide 3D-MASTER

Principles of Shade Selection

1. Teeth to be matched must be clean & moist

2. Remove bright colors from the field of view
    - makeup / tinted eyeglasses
    - bright gloves
    - neutral operatory walls

3. View patient at eye level

4. Evaluate shade under multiple light sources

5. Make shade comparisons at the beginning of the appointment

6. Shade comparisons should be made quickly to avoid eye fatigue.

7. selection distance- a selection made at 3-6 feet from the oral cavity is often more useful since it is representative of the conditions under which the patient teeth will most often be observed.

8. Use of color Contrastors; The color environment plays an important role in our color perception of the grey tooth significantly

9. Shade tap position; Shade tap should be held above the mand tooth or Below the max tooth to be matched and aligned as close as possible to the plane of orientation of the facial surface Of the tooth being matched.

Holding the shade tab over the tooth can give a false impression of the color as the background of the tab is the tooth color rather than the oral

a) Vita Classic Shade Guide

- Very popular shade guide, Tabs of similar **hue** are clustered into letter groups;
- **A (red-yellow) , B (yellow) , C (grey) , D (red-yellow-gray)**



How to use Vita Classic Shade Guide

The manufacturer recommended sequence for shade matching as follows

1. Hue Selection

2. Chroma Selection

3. Value Selection: Because **value level is not involved** in this shade guide, Use of a second, value-ordered shade guide is recommended (**Value oriented shade guide**)

✓**Value-oriented shade guide:**

B1, A1, B2, D2, A2, C1, C2, D4, A3, D3, B3, A3.5, B4, C3, A4, C4,

(bright >>>>>>>>>>>>decrease>>>>>>>>>>>>>>>>>>> dark)

4. Final Check / Revision

b) Vita-3D –Master shade guide

- More precise shade guide, tooth color divided into **5 levels of value**, for each value group deviation from medium hue towards yellow or red.
- In the **medium (M) hue** there are three levels of chroma; while a **more yellowish hue (L)** or **more reddish hue (R)** exists in 2 chroma

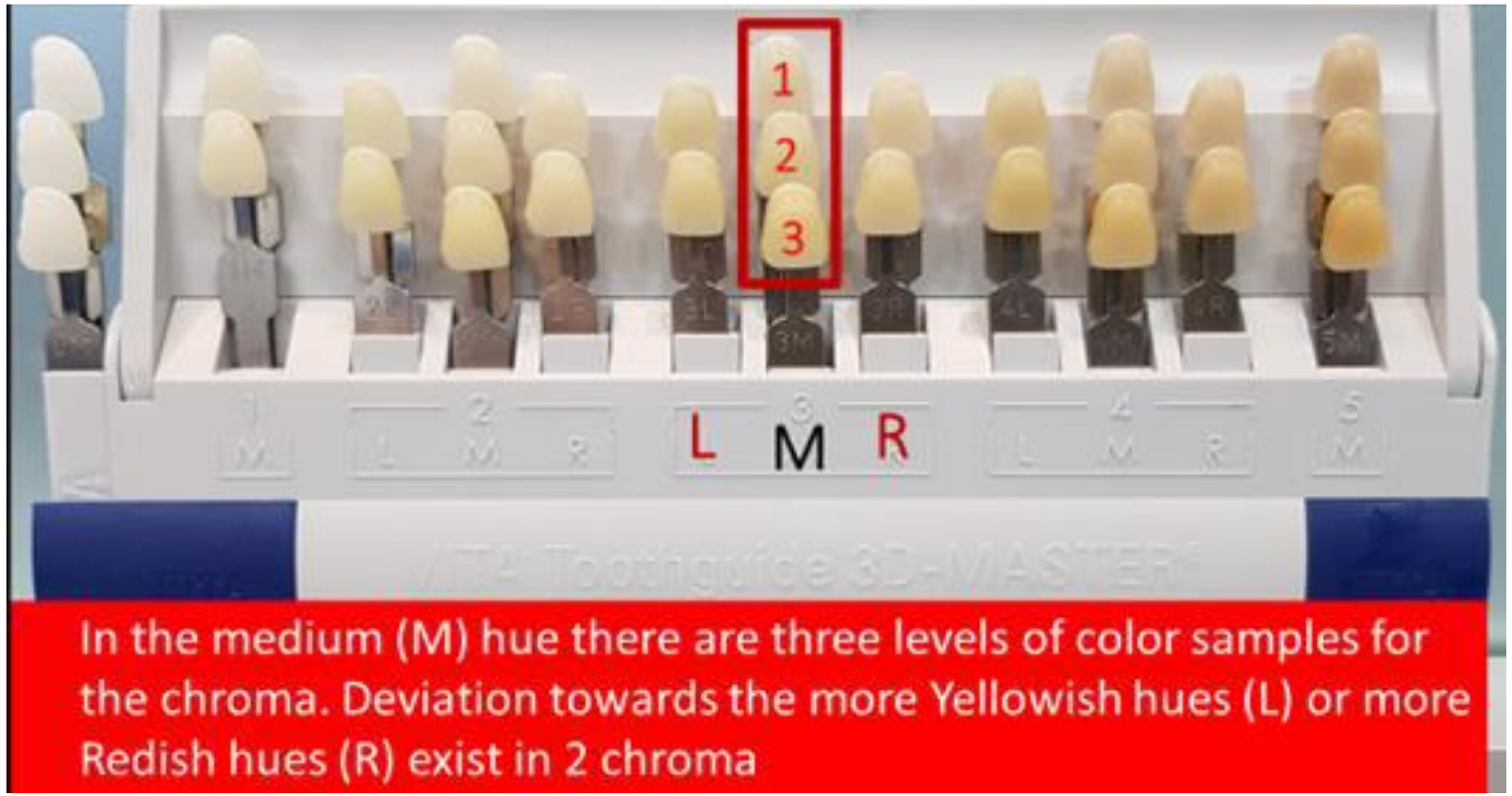


How to use Vita-3D –Master shade guide

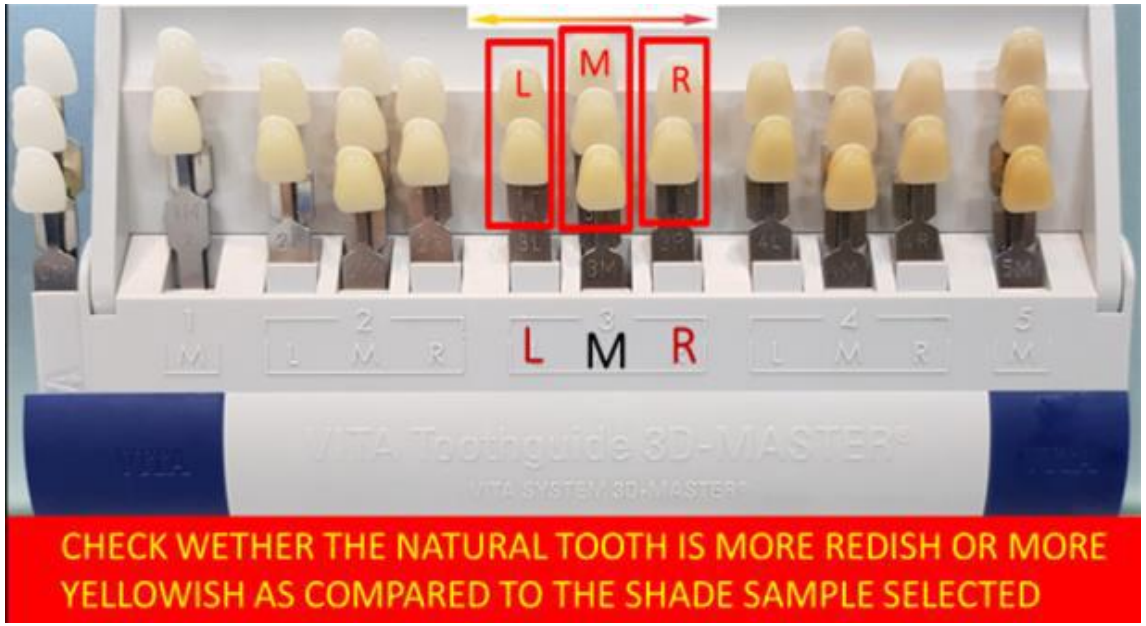
- ***Step 1 Determine*** *the lightness level (value).*
- *Hold the shade guide to the patient's mouth and start with the darkest group moving to the left.*
- *Select Value group 1, 2, 3, 4, or 5*

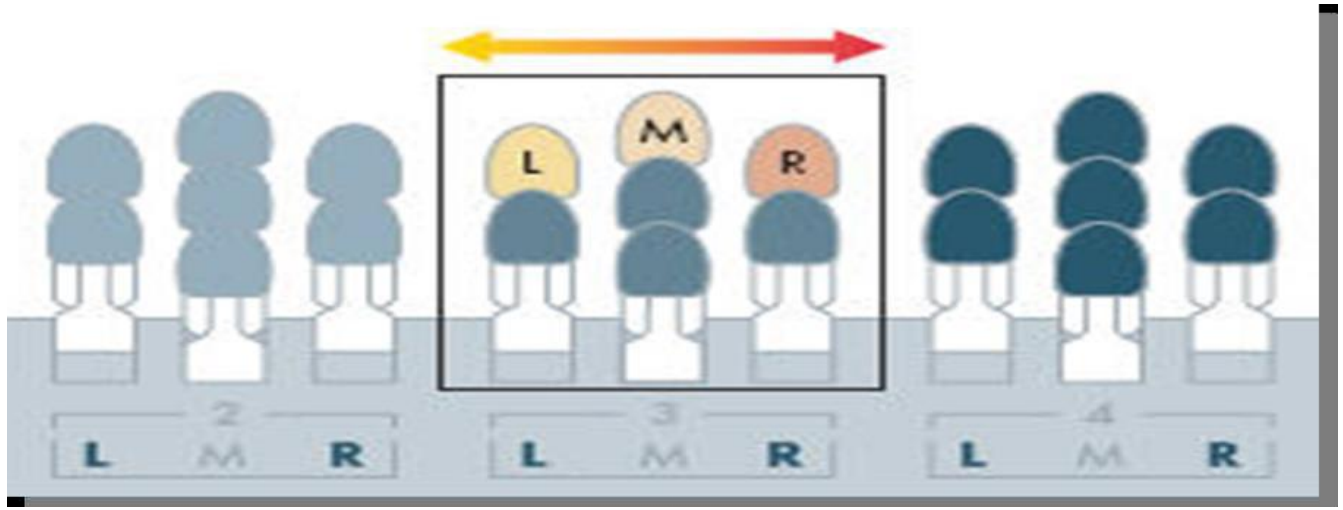


- **Step 2** Select the chroma from your selected Value group, remove the middle tab (M) and spread the samples out like a fan Select one of the three-shade samples to determine chroma.



Step 3 *Determine the* **hue** *and Check whether the natural tooth is more yellowish or more reddish than the shade sample selected.*





c) VITA Linear guide 3D-MASTER SHADE GUIDE

- The all-new VITA 3D-Master Linear guide enables the quick determination of precise tooth shades and uses the same scientific principles and 29 shades found in the popular VITA 3D-Master shade guide.
- The Linear guide features a sleeker, linear design that makes precise shade determination even faster and easier.
- The final shade is achieved in two simple steps:
- first, select from five value tabs and then choose the proper mix of chroma and hue within the selected value range.
- With the VITA Linearguide 3D-MASTER you can determine the correct tooth shade swiftly and accurately.



Shade taking in two steps:

Step 1:Remove the VITA Value guide 3D-MASTER from the top of the Linear guide.

- The correct degree of lightness can be determined by removing the Value guide.
- Make an initial choice using the Value guide.
- you determine the correct degree of lightness from 0 to 5.

Step 2: Make a detailed choice within the determined degree of lightness from step 1 using the corresponding VITA Chroma/Hue guide.





Photography & shade matching

- Consider as an effective technique for shade matching
- Photography greatly simplifies the shade-taking process, particularly for treatment in the aesthetic zone.
- A shade tab is placed next to the tooth and a photograph should taken.



2) Instrumental color analysis (Digital shade-scanning devices)

- **Tooth should be clean & free of debris.**
- **Need to hold the probe perpendicular to the tooth.**
- **There is variation in the color depending on where the probe is located.**
- **Tip centered (1 – 2 mm from gingiva and incisal edge) or do 3 zones (gingival, middle, and incisal).**

There are **two types** of digital shade-matching devices commonly used in dentistry:

1. **spectrophotometer**
2. **the colorimeter**.

- The spectrophotometer accurately measures ***natural tooth*** **coloration about any known specific color or can be based on any shading system**.
- It measures value, chroma, and hue from a standard and provides all the information that is necessary to create an accurate restoration or to modify an existing one such that it will accurately match the tooth.



- The **colorimeter analyzes the tooth coloration based on preloaded data that is related to a shade system.**
- It is **less accurate than the spectrophotometer** but may suffice in most dental situations.
- **Because both spectrophotometers and colorimeters** tend to eliminate ambient light by standardizing the environments of the target tooth, the shade can be taken in any operator with any kind of lighting streaming in through the window.
- **Digital shade taking is far easier, far more practical, and far more accurate than shade-taking using color tabs and the naked eye in a variable environment.**
- The current **best approach** to shade-taking is the **spectrophotometer**. It provides the **most accurate method** for matching the coloration of the tooth.



CYNOVAD SHADESCAN

- The system is user-friendly and is integrated with **computer-aided design and manufacturing (CAD/CAM)** technologies.
- The shade is measured by a handheld optical device from a single image of the whole tooth at the click of a button.
- The dentist can instantly obtain a shade map of the whole tooth with various established and popular shade systems.




Thank
YOU