

ShadeVision Data Interpretation

Full Color tab

On the **Full Color** tab, the teeth are displayed in their natural color, allowing you an unobstructed view of each image. Although tooth color cannot be exactly represented on a computer monitor, *ShadeVision* does use advanced techniques of color management to assure that the color is as close as possible. The use of these techniques allows multiple teeth and a restoration to be evaluated for color difference very effectively. The **Full Color** view also provides an intuitive guide to assessing translucency. Regions near the incisal edge, internal tooth structure and even tooth surface texture (based on glare patterns) can be readily observed as well.

Average tab

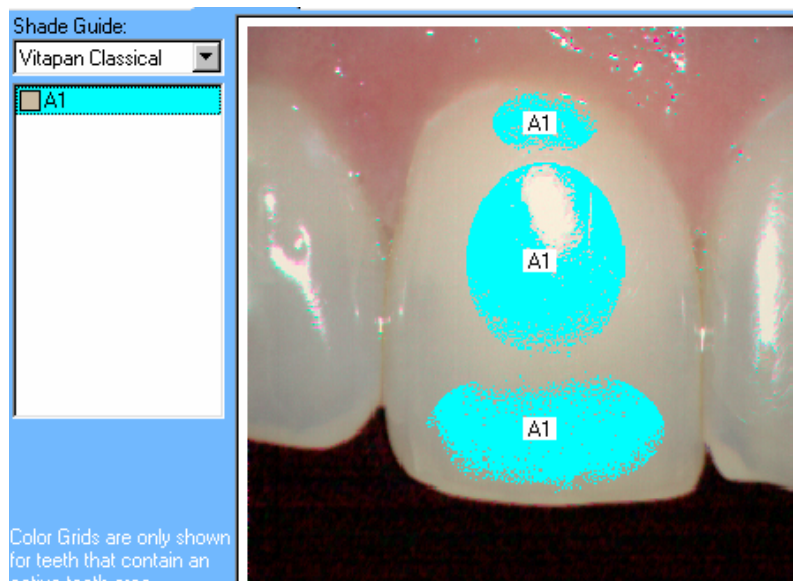
The **Average** tab indicates the average dentin color for each active tooth area. Click a color in the shade guide legend to highlight the location of that color in the tooth images; click again to remove highlighting. In this view, the software is suggesting the single best shade tab that matches the patient's dentition. If the shade assignment is shown in red, it means that the patient's tooth is visually different from the closest shade tab. This is not uncommon as some patient's tooth color is outside of the color gamut of some of the shade guides. Try using a different shade guide manufacturer or type as each of them covers different regions of color space.

Color Grid tab

The **Color Grid** tab identifies the closest shade in the gingival, dentin/middle, and incisal regions of each active tooth area, based on the selected shade guide. Click a color in the shade guide legend to highlight the location of that color in the tooth images; click again to remove highlighting.

Some notes on **Color Grid** –

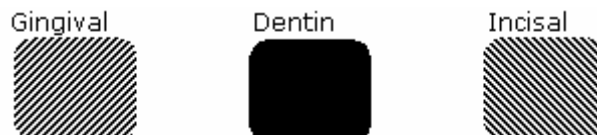
- Evaluates three dynamically defined regions of the tooth as highlighted on the image below. The size of these regions is scaled to be consistent with the cropped region of the tooth. Because these regions are determined by a percentage of the height and width of the **Active Tooth Area**, proper cropping in the **Tooth Definition Wizard** is critical.
- Color information contained in the each of the three regions is averaged.
- The averaged colorimetric data is compared to *ShadeVision's* shade guide database in order to determine shade assignment in each region.
- *ShadeVision* has three separate databases for each shade tab – gingival, middle/dentin, and incisal. When A1 is selected in the incisal of a tooth as in this example, it refers to the incisal portion of the A1 shade tab. The same is true for gingival and middle/dentin shade assignments. The middle/dentin shade assignment will always be the same as the **Average** dentin shade assignment.



Color Map tab

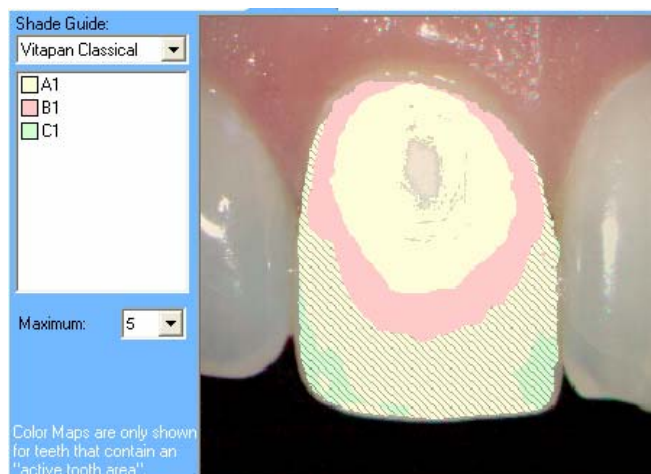
The **Color Map** generates regions of shades found in the tooth. **Color Map** determines the multiple regions for each tooth based on the value/lightness differences found on the tooth. The number of regions generated is controlled by your selection in the **Maximum** field. Click a shade assignment on the shade guide legend to highlight the location of that color in the tooth image. Click again to remove highlighting.

In **Color Map** the following contrasting hash patterns help you distinguish between the incisal and gingival shades from the solid dentin shades.



Some notes on **Color Map** –

- **Color Map** breaks the ENTIRE cropped region of the tooth into regions by value difference.
- It takes all the colorimetric data in each region, averages it, and compares them to the database that the user selected in the “**Tooth Definition Wizard**”.
- The user will need to determine which database (gingival, middle/dentin, incisal) to look in while defining the active tooth area (new in *ShadeVision v.3.01*).
- **Color Map** will typically generate different shade assignments than **Color Grid**. The reason is that **Color Grid** is consolidating different colored regions together to form an average. **Color Map** consolidates color only within a region.

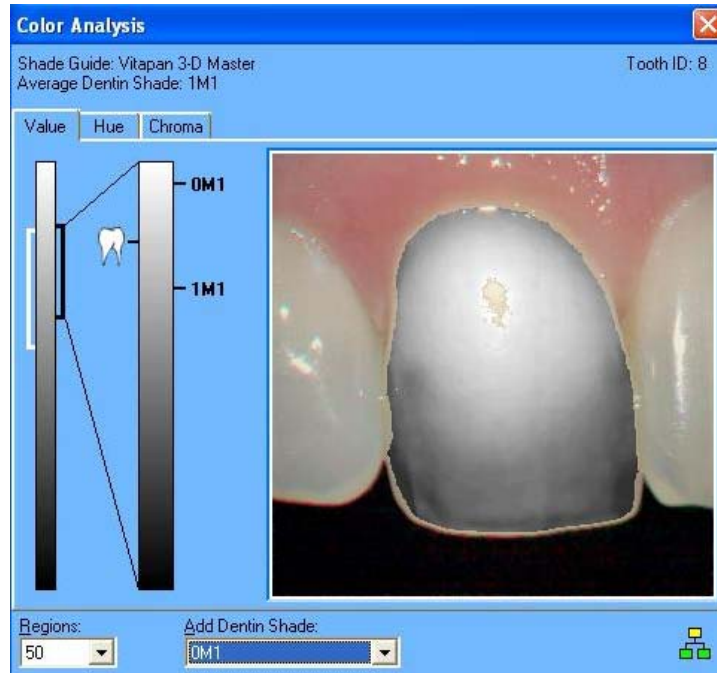


Color Analysis Maps

The **Color Analysis** (Hue/Value/Chroma) windows provide additional detailed color data. This allows the user to assess just how good the **Average** shade selection is. In this example, the measured tooth is being compared to the 1M1 **Average** dentin shade assignment by using hue, value, and chroma. Click on the **Color Analysis** icon located next to the print icon in the **Group Editor** window and then single click on the tooth that you want to review. This will open the **Color Analysis** window displaying the **Value** (lightness/brightness) data. Select the **Value, Hue, or Chroma** tab to display the desired data.

Color Analysis windows compare the average **Value, Hue, or Chroma** of the targeted tooth to the average **Value, Hue, or Chroma** of the selected shade tab assignment on a bar graph. There is a **Value, Hue, or Chroma** “difference map” provided as well. *ShadeVision v.3.01* added the option to include a second shade tab reference to be plotted on the gradient bar for comparison with the targeted tooth. These windows will be described in more detail later.

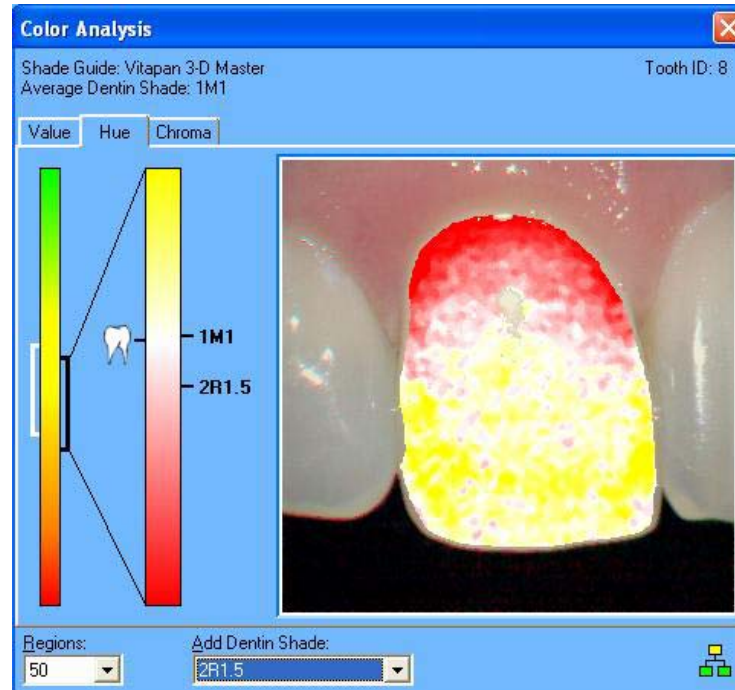
Value Analysis Map



Value is easily defined as the lightness or brightness of a given color. The **Value** tab shows the entire value range in the narrow left gradient bar (black to white). The white bracket indicates where the average value assignment exists in the selected shade guide. The black bracket indicates the entire range of value for the selected tooth exists. This black bracket “explodes” to become the wider gradient bar. The average value of the tooth selected is indicated with a tooth icon and the average value of the assigned **Average** shade is indicated opposite the tooth icon. Use these designations to compare the average value of the tooth to the average value of the shade tab assignment.

This example indicates the average value of the patients tooth measured slightly higher (tooth is brighter) than the assigned 1M1 shade tab so the logical choice for “**Add Dentin Shade**” is 0M2. The value for this tooth is right between 0M1 and 1M1. The value map moves from black to white to represent areas that are “darker” (lower value) or “brighter” (higher value). You can use the tooth icon designation on the wide gradient bar as a starting point to see the relative value difference between this point and the other regions displayed on the map. The map actually indicates how the value changes over the entire tooth surface. Users can select the number of individual value regions from three to fifty by selecting the drop down arrow in the **Regions** box. Most technicians have found this “value difference map” to be an intuitive guide to how they might want to blend their translucent enamel porcelain during build up. As the tooth increases in translucency, value tends to drop. Using this map, along with the **Full Color** image has proven to be extremely useful in blending incisals.

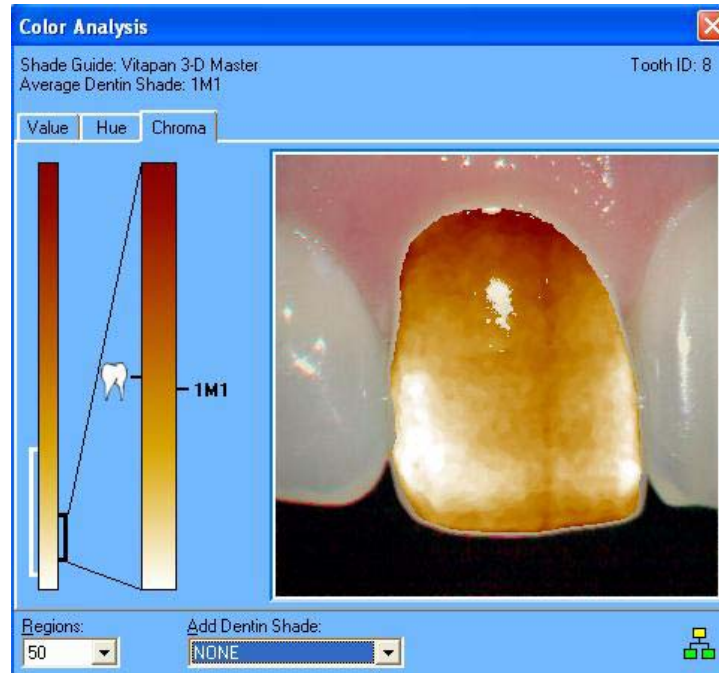
Hue Analysis Map



Hue is our perception of an object's basic color, that is; blue, green, red, yellow. The **Hue** tab shows the entire hue range in the narrow left gradient bar. The white bracket indicates where the average hue of each tab in the selected shade guide exists. The black bracket indicates the entire range of hue in the tooth selected. In the "exploded" gradient bar, only the range of hues contained in the tooth are shown. The hue of the tooth's **Average** dentin is either redder or more yellow than the average hue of the assigned shade tab.

This example tells us that the average hue of the selected tooth is almost the same as the 1M1 shade tab. Adding the 2R1.5 tab confirms this. The hue map is designed to show how mapped hues in the tooth are either redder or more yellow than the **Average** dentin shade, shown as white. Users can select the number of individual hue regions from 3 to the default of 50 by selecting the drop down arrow in the **Regions** box. Some ceramists might find this "hue difference map" useful in making slight adjustments to a restoration in the glaze bake by the use of external stains. The comparison of the average hue of the tooth to that of the shade tab is quite useful also, as indicated earlier.

Chroma Analysis Map



Chroma is defined as the saturation of a particular color. If the hue were red, then the chroma would indicate just how much red exists in that color. The **Chroma** tab shows the entire chroma range in the narrow left gradient bar. The white bracket indicates where the average chroma assignments of each tab in the selected shade guide exist. The black bracket indicates the entire range of chroma in the tooth selected. This black bracket “explodes” to become the wider gradient bar. In the “exploded” gradient bar, only the range of chroma contained in the tooth are shown. The chroma of the **Average** dentin of the tooth selected is indicated with a tooth icon. The chroma of the **Average** dentin of the shade tab assignment is plotted opposite the tooth icon.

In this example, the chroma of the tooth is almost exactly the same as the **Average** chroma of 1M1. The chroma range is mapped from white to brown in order to represent areas that are “weaker” (lesser or lower chroma) or “stronger” (greater or higher chroma) on the “chroma difference map”. You can use the tooth icon designation on the wider gradient bar as a starting point to see the relative chroma difference between this point and the other mapped regions displayed on the “chroma difference map”. Users can select the number of individual chroma regions from 3 to the default of 50 by selecting the drop down arrow in the **Regions** box. Dental lab technicians have found this map to be an intuitive guide to building their dentin material, and then combine it with the value map to indicate how they would cut back for layering their incisal material.

ShadeVision Color Data Questions & Answers

1. Given that **Color Grid** and **Color Map** provide different results, which should a technician use to build a restoration?
 - a. How much time do you have? **Color Grid** provides guidance for a restoration that will look good at reasonable observation distances. At those distances only average colors can be perceived. If you have the time to really make a detailed restoration, that looks good up close, use **Color Map** to understand how color is varying on the tooth. **Full Color** view will allow you to even understand internal structure and translucency.
 - b. Don't forget that the **Color Map** contains regions that include the darker, more translucent periphery of the tooth being measured. That along with the lack of averaging across colors causes higher shade variation in this view than either of the averaging views.
 - c. We've updated with *ShadeVision v.3.01* to make our **Color Map** more useful that allows the user to custom select which database to look in. If a tooth is translucent for 2/3 of the tooth, then you can look into the incisal database for that 2/3 of the tooth. The same can be done with the gingival and middle/dentin databases.

2. What is the best view for guiding the staining process?
 - a. The **Full Color** image is useful in showing just how the reported shade falls off as you go towards the mesial, distal, and incisal regions of the tooth. It is most helpful in determining characterization as well as internal/external staining and modifiers to be used.
 - b. Many technicians have found the **Hue**, **Value**, and **Chroma** maps to be very useful while glazing and/or staining as well

3. What about translucency?
 - a. *ShadeVision* "sees" the tooth just as you do. Translucency is plainly visible in the images that are acquired. We do not currently assign a numeric value on translucency.
 - b. The **Value** map provides a detailed display of how the value changes over the tooth surface. As the tooth becomes more translucent, the value drops. As a result, our **Value** map provides the technician with an intuitive guide to where translucency exists as well as how it blends with the rest of the tooth.

Question & Answers continued...

- c. The **Full Color** image is extremely useful in determining just how much translucency is present and how you would blend it in your porcelain powder build up.
 - d. The technician can often determine incisal color such as blue, violet, and pink in the **Full Color** image.
4. How about enamel cracks, hypo-calcification, stain lines, craze lines and similar shade information?
 - a. Once again, the best information is readily available in the image. There is no better way to describe these anomalies than by showing you it!
 - b. The **Value** map can often display internal structure also.
5. Do you report value?
 - a. Yes **ShadeVision** software includes **Value, Hue, and Chroma** maps. These windows compare the actual tooth to the average shade assignment graphically, as well as mapped on the tooth image.
 - b. Additionally, the user can select another shade tab from the selected shade guide to compare to the tooth with regards to **Value, Hue, and Chroma**.
6. How does glare affect the data?
 - a. The glare is automatically eliminated from the color assessment by our software. It will not contribute to the shade assignments.
 - b. We originally considered removing the glare altogether from the image, however the dental experts seemed to want it included in the image as a way to assist them in determining surface texture. Most technicians and dentists agree that surface texture is critical to creating an esthetically pleasing restoration.

ShadeVision Color Data Conclusion

X-Rite's ShadeVision System is providing a great deal of detailed information for the creation of dental restorations. *ShadeVision* is giving more shade information to a dental technician than what they've ever seen before. This might lead a technician to ask what color data is best to use to ensure a high quality, esthetic restoration that is expected from a *ShadeVision* dentist.

There are more than 400 dental labs currently using *ShadeVision*. Some use the **Average** shade and the **Full Color** image, while others might use **Color Grid, Color Map, Hue/Value/Chroma**, along with the **Full Color** image. In any case, the most important feature of the system is the ability to measure the finished restoration and then visually assess exactly how it will look in the patient's mouth. *X-Rite* calls this the "**Virtual Try-In**". If the finished restoration looks good and blends well, then send it to the dentist with confidence. If it doesn't look good, then make corrections to allow it to blend with the natural dentition.

If restorations are consistently mismatching at the "**Virtual Try-In**", it might indicate that the technician's technique should be altered. It is important to note that the technique used to create a restoration is as individualized as the technician building it. One technique might work better for one technician or lab than another technician or lab. One dental porcelain manufacturer might recommend a different technique than another manufacturer. A 200-person, production-based dental lab will most certainly endorse a different porcelain build technique than a 4-person, quality oriented, and esthetic lab. How they provide an acceptable match is up to them. The most important step is quality checking the restoration with the "**Virtual Try-In**". If it matches, everybody wins.