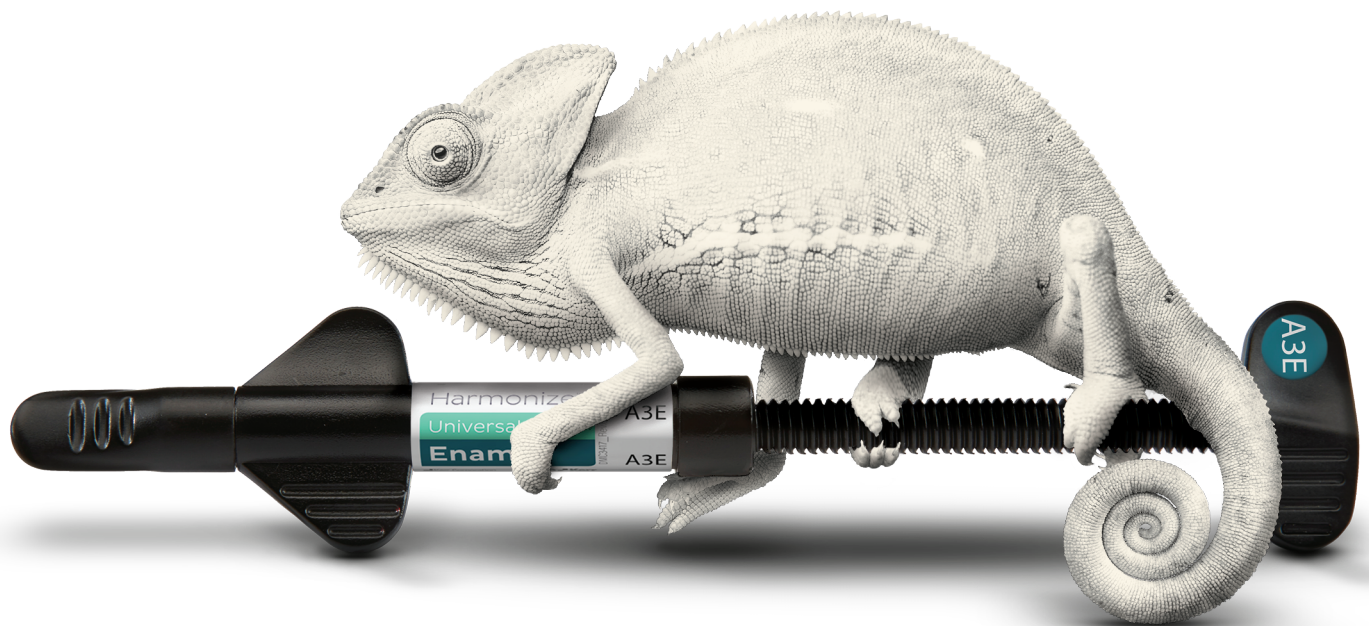


Copying nature,
made naturally easy.



Harmonize™

A practical guide to shade matching

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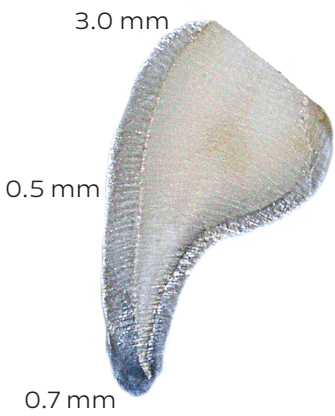
Colour perception

As accurate colour matching remains one of the most challenging tasks in clinical dentistry, it is essential to have a detailed understanding of the fundamental optical properties of natural teeth, which involves a complex interaction of a range of factors.

Factors affecting the optical properties of natural teeth and restorative materials

- Tooth shape
- Surface texture
- Composition/structure
- Adjacent soft tissues (+ the pulp in vital teeth)
- Characterisations and intensive colours
- Opalescence and fluorescence
- Translucency/opacity
- Thickness (see right)

Average enamel thickness



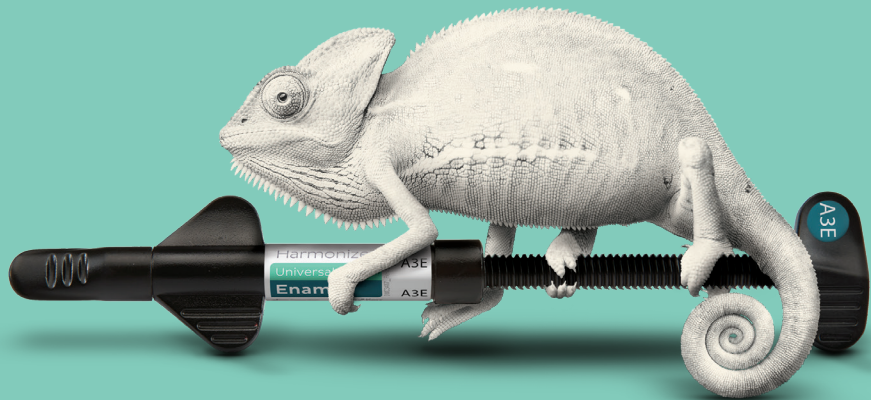
The Munsell colour system

Hue	The name of the intrinsic colour	Corresponds to the wavelength of reflected light The hue of teeth is mainly determined by the colour of the dentine which lies predominantly in the yellow part of the spectrum
Chroma	Saturation/intensity of a specific colour	As shade numbers increase, teeth/restorative materials become more chromatic (and generally darker/yellower)
Value	Amount of light reflected back to the observer, brightness, lightness/darkness	This is the most influential colour dimension and makes up 70% of a tooth's/restorative material's colour

Colour matching is an essential skill in dentistry. All the following shade matching tips are illustrated with clinical cases to increase the quality, consistency, speed and predictability of shade matching procedures when using Harmonize™.

Harmonize™

Harmonize™ is a Nanohybrid Universal Composite (Kavo Kerr) with a high filler load (81%) made up of fused zirconia and silica particles. In addition to the advanced physical and handling properties listed, Harmonize's highly translucent resin matrix and innovative filler particle technology allows restorations to closely mimic the reflective characteristics of human teeth and enhance blending with the residual tooth tissues, "the chameleon effect".



Highlights of Harmonize™

- **Unmatched aesthetics**
Light diffusion and reflection similar to human enamel
- **Exemplary sculptability**
Easy and fast to place restoration and build anatomy
- **High mechanical strength**
Reduced long-term risk of chipping/fractures

Harmonize's™ innovative spherical, consistently sized, nanofiller particle technology enables it to achieve a high polish, superior gloss retention and exceptional aesthetics.

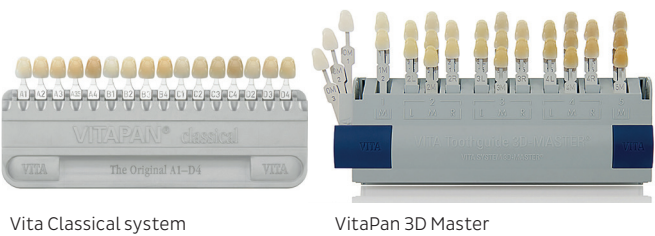


Shade matching

Shade matching in dentistry is usually performed visually using shade guides. Like most modern aesthetic restorative materials, Harmonize™ is shaded using the Vita Classical system (Vita Zahnfabrik Germany).

Vita Classical system is a range of 16 shade tabs arranged in different hues (A to D) and in varying chroma levels (1 to 4).

The more recently introduced, value-based, VitaPan 3D Master (Vita Zahnfabrik Germany) shade guide is considered to have increased the clinical relevance of the range and the distribution of tooth colours, and each shade is denoted by three digits, for example: Shade 3M1 (3 = value, M = hue, 1 = chroma).



When choosing shades of Harmonize™ either the Vita Classical or the VitaPan 3D Master shade guides may be used as a quick-and-easy, cost-effective guide to shade selection.

Lighting conditions

Light quality is very influential on tooth shade determination. As daylight quality undergoes tremendous variation throughout the day (1,000 to 10,000 degrees Kelvin) and dental unit and fluorescent lights can have large variations in the wavelengths of emitted light, it is recommended to use specialised handheld, colour-corrected light sources for colour matching. The standard for colour matching is 5,500K, encompassing the full spectrum of colour wavelengths. The repetition of colour assessment under different light sources is also recommended to avoid metamerism. While bright illumination is essential for perceiving subtle variations in hue/chroma, lower- intensity light may be used for studying value. This also allows enhanced perception of surface texture detail.

Single-shade technique

Harmonize’s™ enhanced blending properties allow most damaged teeth to be restored with a single shade of composite, especially when restoring small cavities (e.g. class III), all classes of posterior composite restorations, teeth with uniformly opaque enamel (e.g. in young patients) or when providing multiple restorations as in the following case.

Fundamental practical tips for shade matching with Harmonize™

- Clean to remove stains (Fig .1).
- Measure shade in daylight and ideally using colour-corrected light sources (approx. 25 cm observation distance is recommended)
- Multiple angles of view should be employed.
- As well as Vita Classical and VitaPan 3D Master, shade guides fabricated from Harmonize™ may also be used².
- Hold the shade guide adjacent to the teeth and move left/right to determine value.
- Assess value from further away (e.g. one metre) and when squinting
- Select the three closest shade tabs before beginning a process of elimination. Use the middle third of the subject or adjacent tooth to determine the basic shade, as colour typically ranges from the cervical to the incisal areas.
- Document tooth colour by taking photographs with the shade tab(s) in place. Avoid bright colours in the surrounding environment, e.g. lipstick, clothing.
- Take shade quickly as cones rapidly become accommodated (5–7 seconds) to similar yellow (and red) colours
- When shade taking, the first impression is usually the most accurate. Team-based discussion is encouraged.

2. Manauat J, Salat A. Layers: An atlas of composite resin stratification; 2013. Quintessence International



Two-layer technique

Enamel and dentine have different structural characteristics and consequently exhibit different optical properties. Enamel is translucent and allows some light to pass through into the more opaque dentine which absorbs light and reflects subtle colours back to the observer through the translucent enamel. The final tooth colour is determined by a combination of the reflective and absorptive properties of enamel and dentine.

As an exact single-shade match in dentistry is rare, layered combinations of translucent and opaque Harmonize™ composite shades may be used to mimic the optical properties of enamel and dentine. It is recommended to apply the minimum number of layers that will achieve optimal aesthetic integration.

Translucency

Translucency is regarded as one of the most important factors influencing aesthetics, as it determines how much of the underlying dentine, deeper restorative material layers and dark background of the oral cavity show through. One of the most difficult tasks in dentistry is to define the degree of enamel translucency, and for this reason Harmonize™ is available in a range of shades offering different translucencies.

Generally, the translucency of resin composite is related to its thickness and the dimensions, and the proportions of dentine and enamel layers greatly influence the final outcome of a layered composite

restoration. There is also a high correlation between translucency and value, with lighter shades having greater translucency.



Harmonize™ shades of differing translucency

Recommended layer thickness when using Harmonize™

Harmonize	Shades	Thickness range
Enamel (translucent)	A1, A2, A3, A3.5, A4, B1, B2, B3, B4, C1, C2, C4, D2, D3, D4, XLE	0.3–0.7 mm
Dentine (opaque)	A1, A2, A3, A3.5, A4, B3, C4, XLD	1.0–3.0 mm
Incisal (Increased translucency)	Clear / SuperClear / Blue / Amber / Grey	0.1–0.2 mm

Intermediate practical tips for two-layer shade matching with Harmonize™

- Initial selection of the basic shade of Harmonize™ is carried out as in case 1. This may be facilitated by placement and light curing of a sample on the middle third of the tooth to be restored (Fig. 1).
- Where the tooth to be restored closely matches a specific VITA shade, use analogous Harmonize™ enamel and dentine shade tabs of varying thickness to determine the optimal translucency/opacity for layered restorations.
- Translucency is best evaluated using a black background, e.g. with a contraster (Fig. 2).
- Where the closest VITA shade has slight chromatic differences from the natural tooth, use customised shade tabs featuring different combinations of enamel and dentine in standardised thicknesses for precise shade selection (Fig. 3).
- Study cavity size, shape, position and measure the relative thicknesses of residual enamel and dentine. Deeper composite layers should conform to the anatomy of natural dentine (Fig. 4).
- As a general rule it is recommended to replace enamel layers at only 50% of the thickness of lost enamel (Fig. 5).
- Surface gloss has a significant impact on the optical properties of teeth (Figs. 6–8).
- During restorative procedures full dehydration is reported to occur after approximately 30–40 minutes
- As it can take up to 2–3 days for teeth to fully rehydrate, monitoring is important. Fig. 9 shows optimal integration of a class IV Harmonize™ restoration at one year post-operatively.



Polychromatic layer technique

Natural teeth have unique, complex, colour variations that are perceived and interpreted by the human brain. In some clinical situations, the imperceptible integration of composite restorations cannot be achieved without the sophisticated blending of colours, by the placement of multiple layers with different optical properties^{1,2}.

Harmonize™ incisal shades (Fig. 1: grey, amber and clear) allow the precise replication of complex optical properties caused by localised anatomical variations such as those listed and illustrated below.

Opalescence

Hydroxyapatite crystals in enamel act like prisms, giving teeth a blue or amber appearance under transmitted and reflected light, respectively (Figs. 2, 3).

Halo effect

This phenomenon occurs where aprismatic incisal edge enamel lies adjacent to translucent, highly organised, densely packed hydroxyapatite crystals (Fig. 3).

Fluorescence

Absorption of light primarily by the dentine causing spontaneous emission of brighter, longer wavelength light.

Characterisations

Localised mineralisation differences, of varying aetiologies, are common in tooth structure and may result in a range of white patches and unusual colourations (Fig. 4).

Intensive colours

These white or coloured areas of differential mineralisation are variations of abnormal anatomy (Fig. 5).

Surface texture

As well as surface gloss, macro- and micro-surface texture features greatly influence the way that natural teeth react with light (Fig. 6).

Macro-texture	Micro-texture
Developmental lobes	Accessory grooves
Developmental grooves	Perikymata
Cervical bulge	Imbrication lines
Mamelons	

1. Mackenzie L, Parmar D, Burke FJT, Shortall AC. Direct Anterior composites: A practical guide. Dent Update. 2013 May; 40(4):297-317
2. Manauat J, Salat A. Layers: An atlas of composite resin stratification; 2013. Quintessence International



Advanced practical tips for polychromatic shade matching

- In aesthetically demanding clinical situations the design of restoration shape, surface texture and polychromatic colour may be enhanced by the use of close-up photography and the construction of a preoperative shade map (Fig. 1).
- Digital single lens reflex (DSLR) cameras/macro lenses with standardised settings are recommended (Fig. 2)
- Use neutral backgrounds for clinical photography (Fig. 3).
- Use black and white photography to determine correct values (Fig. 4).
- Twin flashes, rather than ring/point flashes, allow better assessment of surface texture details. Slightly underexposed images may also be used to study surface texture.
- Do not deviate from preoperative shade maps as teeth lighten during restorative procedures (full dehydration occurs after approx. 30–40 min.)
- Start with placement of a translucent enamel “shell” which may be easily formed using a palatal silicone template constructed from a preoperative wax-up (Fahl et al 1995) (Fig. 5).
- Opaque dentine lobes are then restored and left short of the incisal edge by 1.0–2.0 mm (Fig. 6).
- The final labial enamel layer is then placed before carrying out shaping, finishing and polishing procedures (Fig. 7).
- Standardised camera settings, positioning and a black contraster enable consistent before and after clinical photographs (Figs. 8, 9).

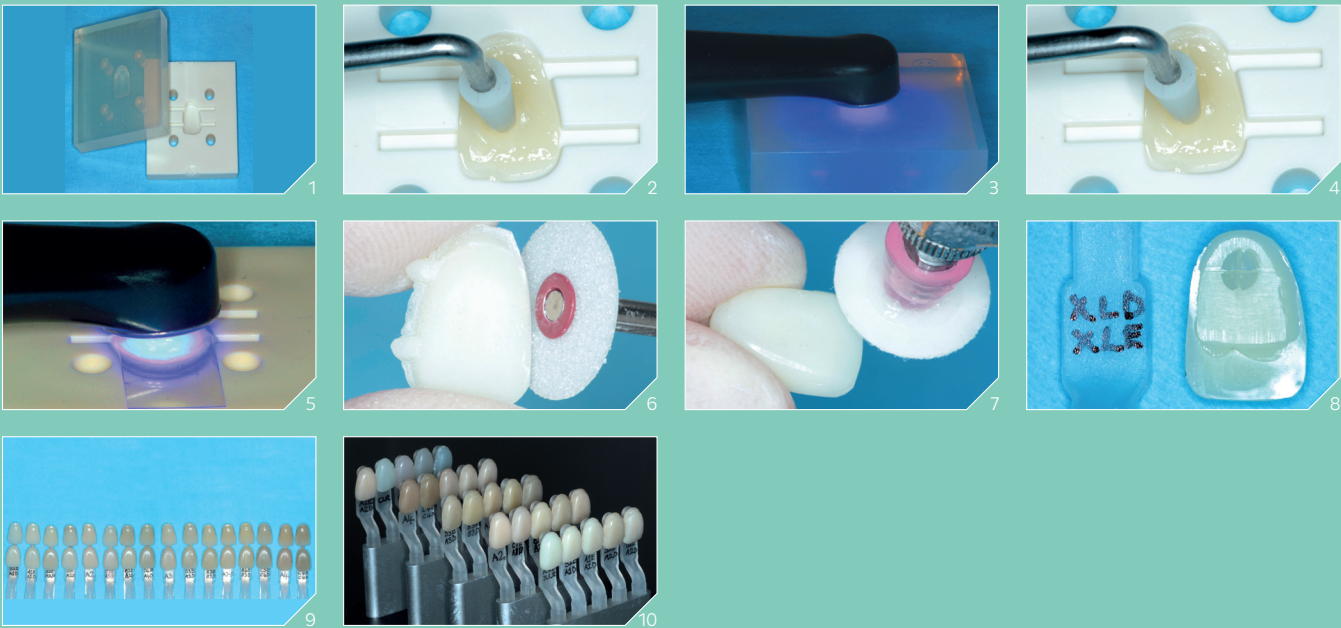


Practical tips for construction of custom-made Harmonize™ shade guides

Although Harmonize™ is designed to be used with either Vita Classical or VitaPan 3D Master shade guides, the ideal shade guide is fabricated from the composite material that will be used^{1,2}.

- Use an innovative Smile Line silicone template in accordance with published guidelines² (Fig. 1).
- An initial increment of an enamel shade of Harmonize™ is placed into the base of the template, using a silicone-tipped instrument (CompoRoller™ Kavo Kerr) (Fig. 2).
- The enamel layer of Harmonize™ is then light-cured through the silicone template (20 sec.) (Fig. 3).
- The enamel shell is filled with a dentine shade to create a layered Harmonize shade tab of known thickness. The cylindrical silicone CompoRoller™ tip simplifies this stage (Fig. 4).
- The dentine layer is then light-cured through a clear matrix strip (Hawe Striproll™ Kavo Kerr) for 60 seconds (Fig. 5).
- Coarse finishing discs (OptiDisc™ Kavo Kerr) may be used to remove the gross marginal excess (Fig. 6).
- Buffing discs, used with light pressure, are all that is required to create a high polish on the labial surface of the Harmonize™ shade tab sample (Fig. 7).
- Superglue is then applied to the palatal surface of the shade tab. Once set, it is clipped on to the specialised handle which is marked using an indelible felt pen with the prescribed shade combination for future reference (Fig. 8).
- Harmonize™ enamel and dentine composite layers may be used in combination to exactly replicate the entire range of Vita shades (Fig. 9).
- Harmonize™ shade tabs should be properly displayed and organised in the specialised Smile line stand (Fig. 10).
- An unlimited range of shades may be created using Harmonize™, allowing fast, efficient, precise colour matching with natural teeth, whether using one, two, or multiple polychromatic layering techniques (right side).

1. Mackenzie L, Parmar D, Burke FJT, Shortall AC. Direct Anterior composites: A practical guide. Dent Update. 2013 May; 40(4):297-317
2. Manuat J, Salat A. Layers: An atlas of composite resin stratification; 2013. Quintessence International



Summary of Harmonize™: A practical guide to shade matching

In the table below the Harmonize™ shade selection and stratification guidelines are listed, to create beautiful, undetectable restorations in an easy way.

Step 1: Select Vita shade guide	Vita™ classical system	-	B1	A1	B2	D2	A2	C1	C2	D4	A3	D3	B3	A3.5	B4	C3	A4	C4
	VitaPan 3D Master system	Bleach shades	1M1	1M2	4L2.5	3M1 3M2	2M2	3M1 2R1.5	3L2.5	3L1.5	3M2 3M3 2R2.5	4M1	3L2.5	3M3 4M2	3M3	4L1.5 4M2	4L2.5	5M2

Harmonize shade recommendation	Dentin Layer	XLD	A1	A1	A2	A2	A2	A1	A2	A4	A3	A3	B3	A3.5	B3	C4	A4	C4
	1.0–3.0 mm																	
	Enamel layer	XLE	B1	A1	B2	D2	A2	C1	C2	D4	A3	D3	B3	A3.5	B4	C3	A4	C4
	0.3–0.7 mm																	
Incisal Layer(s)		Incisal layer TC, TSC, TB, TA, TG																

Incisal layer TC: translucent Clear / TSC: translucent SuperClear / TB: translucent Blue / TA: translucent Amber / TG: translucent Grey

Syringe Intro Kit	REF/Part No.
4x 4 g Syringe (1x Dentin A3, 1x Dentin A3.5, 1x Enamel A2, 1x Enamel A3), instructions for use.	36633

Unidose intro kit	REF/Part No.
40x 0.25 g Unidose (10x Dentin A3, 10x Dentin A3.5, 10x Enamel A2, 10x Enamel A3), instructions for use.	36634

Syringe advanced kit	REF/Part No.
8x 4 g Syringe (1x Dentin A2, 1x Dentin A3, 1x Dentin A4, 1x Enamel A2, 1x Enamel A3, 1x Incisal Amber, 1x Incisal Clear, 1x Incisal Grey), instructions for use.	36635

Harmonize™ refill shades	1x 4 g Syringe	20x 0.25 g Unidose
Dentin A1	36545	36571
Dentin A2	36536	36572
Dentin A3	36546	36573
Dentin A3.5	36547	36574
Dentin A4	36548	36575
Dentin B3	36549	36576
Dentin C4	36550	36577
Dentin XLD	36551	36578
Enamel A1	36552	36579
Enamel A2	36537	36542
Enamel A3	36553	36581
Enamel A3.5	36554	36582
Enamel A4	36555	36583
Enamel B1	36556	36584
Enamel B2	36557	36585
Enamel B3	36558	36586
Enamel B4	36559	36587
Enamel C1	36560	36588
Enamel C2	36561	36589
Enamel C3	36562	36590
Enamel C4	36563	36591
Enamel D2	36564	36592
Enamel D3	36565	36593
Enamel D4	36566	36594
Enamel XLE	36567	36595
Incisal Translucent Amber	36538	36543
Incisal Translucent Blue	36568	36597
Incisal Translucent Clear	36569	36598
Incisal Translucent Grey	36570	36599
Incisal Translucent Super Clear*	36539	Not available

* 3g Syringe