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Matchmaker:

Microlayering and the Best of Different Worlds

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All-ceramics have been a part of my dental life for more than 25 years. In that time, I have seen many developments come and go—and more than a few short-lived trends. My personal all-ceramic journey has led me to a combination of new and revolutionary materials and digital technologies that have transformed the way I approach all-ceramic restorations. The key material in our laboratory is zirconia (also known by its full name, *zirconium dioxide*), which we have been working with since 2005. Initially used only as a framework material, zirconia

is regularly used in labs all over the world as a monolithic material, and today we also use it as the basis for microlayering. Microlayering is a completely new chapter in our all-ceramic story.

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Microlayering: A Peek Behind the Curtain

To realize its potential, it is important to understand what microlayering is, what it is not, and how it differs from other ceramic veneering techniques. Microlayering is not a figment of the imagination or a mere fad. Nor is microlayering a renaissance of partial veneering. Microlayering is an independent process technology that has evolved from the needs of everyday laboratory work. The primary problem is the “veneering” bottleneck, which

has repeatedly caused chipping in the classic layering technique.¹ A practical solution to this problem, which is based on the material properties of the framework and veneering ceramics, has never been found.

However, zirconia was developed for monolithic restorations and has been optimized over time to achieve esthetically satisfactory results. This approach also meets the current demands of our patients. Patients today have high expectations and clear esthetic requirements. They want a high standard of restorative care, even if their financial resources are limited.

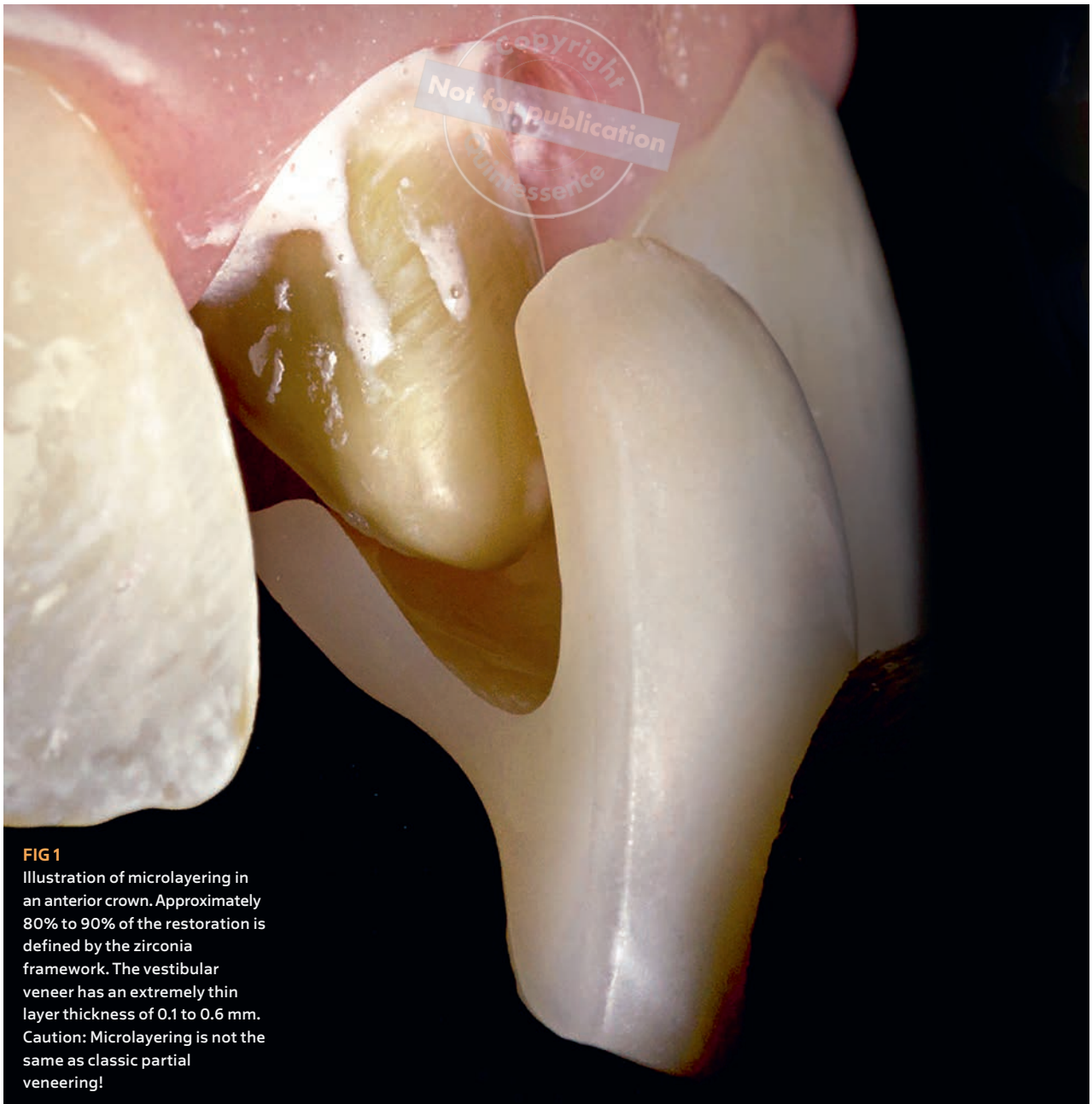
**FIG 1**

Illustration of microlayering in an anterior crown. Approximately 80% to 90% of the restoration is defined by the zirconia framework. The vestibular veneer has an extremely thin layer thickness of 0.1 to 0.6 mm. Caution: Microlayering is not the same as classic partial veneering!

The next milestone in the history of all-ceramics was the development of multilayer zirconia. Over time, multilayer zirconia has been optimized in terms of esthetics and material properties, and several generations of zirconia have been introduced to the market.²

The development of 4Y-TZP zirconia started a paradigm shift in our laboratory. Soon there was a desire for monolithic restorations with an ultrafine veneer for even more natural esthetics. Microlayering was developed to avoid the sensitivity (chipping) associated with the traditional veneering technique. However, to be truly successful, this approach requires special materials³ (Fig 1).

Framework Material

The foundation is always the zirconia framework. We have been working with monolithic restorations in our laboratory since 2014 and have closely followed developments in the field of zirconia. As the framework represents the dentin core or dentin layer in microlayering, special requirements apply. It is no exaggeration to say that today we have access to the best framework materials of all time. Modern multilayer zirconia leaves little to be desired.

FIG 2

ArgenZ HT+ Multilayer: sophisticated shade color distribution over seven layers, seamless color gradient, and uniform flexural strength.

**FIG 3**

The framework as a shade base for microlayering (ArgenZ HT+ Multilayer). The framework replaces the dentin layer.



A major driver for the establishment of microlayering was the introduction of 4Y-TZP zirconia,² with its multilayer structure (eg, ArgenZ HT+ Multilayer, Argen Dental). We now have a material with high flexural strength and high esthetics.⁴ ArgenZ HT+ Multilayer offers all the advantages of a multilayer material, but it is made of 4Y-TZP zirconia throughout (Figs 2 and 3). It does not combine different generations of zirconia, which we believe is advantageous for everyday laboratory work and represents the status quo for a modern zirconia.

Multilayer zirconia boasts the following characteristics:

- Consistently high strength
- Seamless transition of color structures and ideal optical properties
- Consistent material quality
- Excellent accuracy of fit and uniform restoration margins
- Smooth, uniform surfaces

The esthetic finish is achieved by the original multi-color structure of the zirconia (monolithic), by shade enhancement with ceramic stains (staining technique), or with veneer-like microlayer veneering (microlayering).



FIG 4 GC Initial IQ ONE SQIN system: a special shape and texture liquid gives the ceramic an almost plastic consistency.



FIG 5 The system contains luster materials (ceramic stains) for internal characterization (eg, fluorescence) and serves as a bonding layer for the framework-ceramic bond.

Microlayering Ceramics

Microlayering produces a layer approximately 0.1 to 0.6 mm thick. To meet the optical challenges of such a thin layer, ceramic masses with specific formulations are required.

GC began working with minimal-layer veneering more than 12 years ago, creating the basis for today's microlayering offering: the GC Initial IQ ONE SQIN shade and shape concept. We now have a state-of-the-art, innovative material concept at our disposal that has been developed on the basis of the manufacturer's many years of experience. The result is a high level of safety in the sensitive area of all-ceramic restorations.

The multifunctional system can be used for purely monolithic, superficial applications as well as for high-end esthetics by means of internal characterization. Esthetic refinement is achieved with a thin layer of a special feldspar ceramic.³

Microlayering ceramics are characterized by the following (Figs 4 and 5):

- Feldspar-based materials with small particle size (minimum sintering shrinkage and maximum bond quality)
- Self-glazing effect (only available with some ceramic systems, eg, GC Initial IQ ONE SQIN)
- Very good wetting of the framework surface (GC Luster Paste supports the transfer layer between the framework and the veneering ceramic with its very fine grain. The internal characterization shades also act as a bonding agent.)

Parallel to the material developments, rapid improvements in the field of software have opened up intelligent possibilities for managing even complex patient cases by means of a fully fledged virtual simulation (virtual articulator, face scan, joint and masticatory data acquisition, etc). The combination of framework material, special ceramics, and digital technologies provides the optimal basis for microlayering.

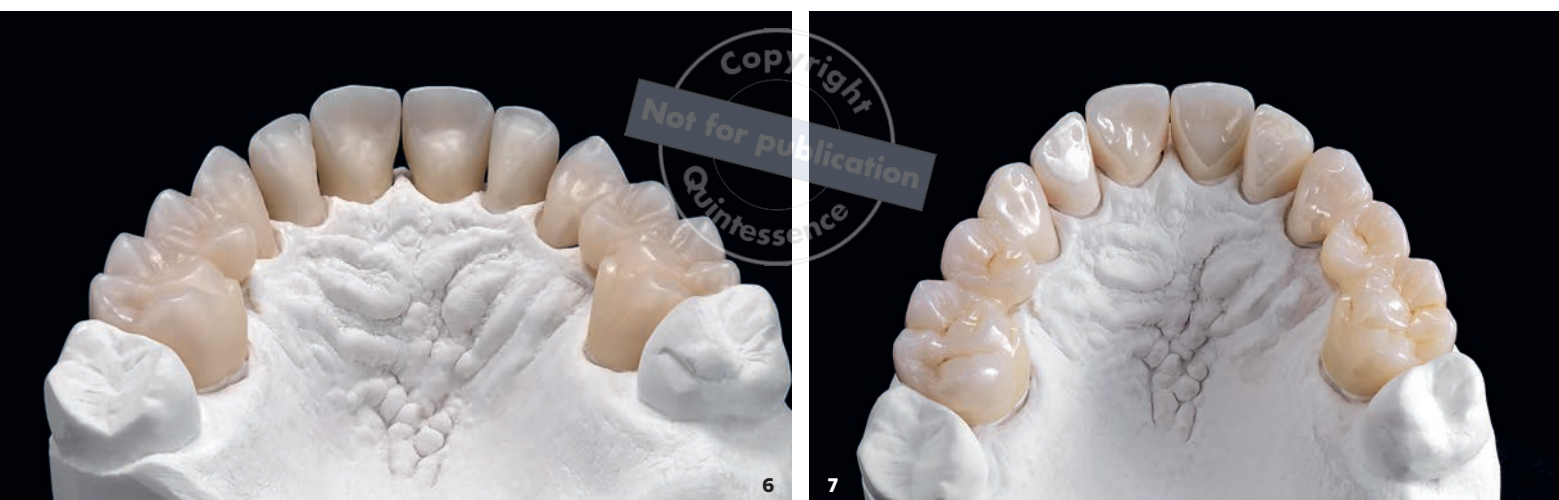
For a successful implementation of the process, it is essential to know and observe the basics of dental technology and materials science—framework design, thermal treatment, correct processing before and after sintering, framework preparation, etc.

To summarize, microlayering is defined by the following:

- Basic shade and shape defined by the multilayer zirconia framework
- Layer thickness between 0.1 and 0.6 mm
- Veneering in the visible area
- Use of special stains with a 3D effect
- Internal staining technique and buildup

#EveryEmployeeCounts

To address the skills shortage, we need forward-looking work concepts that make our profession more attractive, both emotionally and financially. Change is welcome if it makes everyday work easier without compromising quality. This is exactly what microlayering offers.



FIGS 6–8 All-ceramic zirconia restorations (ArgenZ HT+ Multilayer). The posterior restorations are monolithic. They can be easily fabricated by a junior technician under supervision. The anterior restorations have been finished by microlayering.

Classic ceramic layering is an artistic activity that works well and can produce great results. But it requires a lot of know-how and experience. And because hardly anyone is a natural-born artist, dental technicians have to spend their years developing each individual ceramic layer in a disciplined manner.

As a rule, it is no longer possible today to train young dental technicians in the classic layering technique, because it can take years before they are able to use it routinely. This is where microlayering offers a welcome

solution. The basic shape of the restoration, functional contact surfaces, proximal contacts, etc., are defined by the framework. This simplifies esthetic finishing. In this way, even novice dental technicians can be successful in all-ceramics and be placed in an appropriate salary structure (Figs 6 to 8).

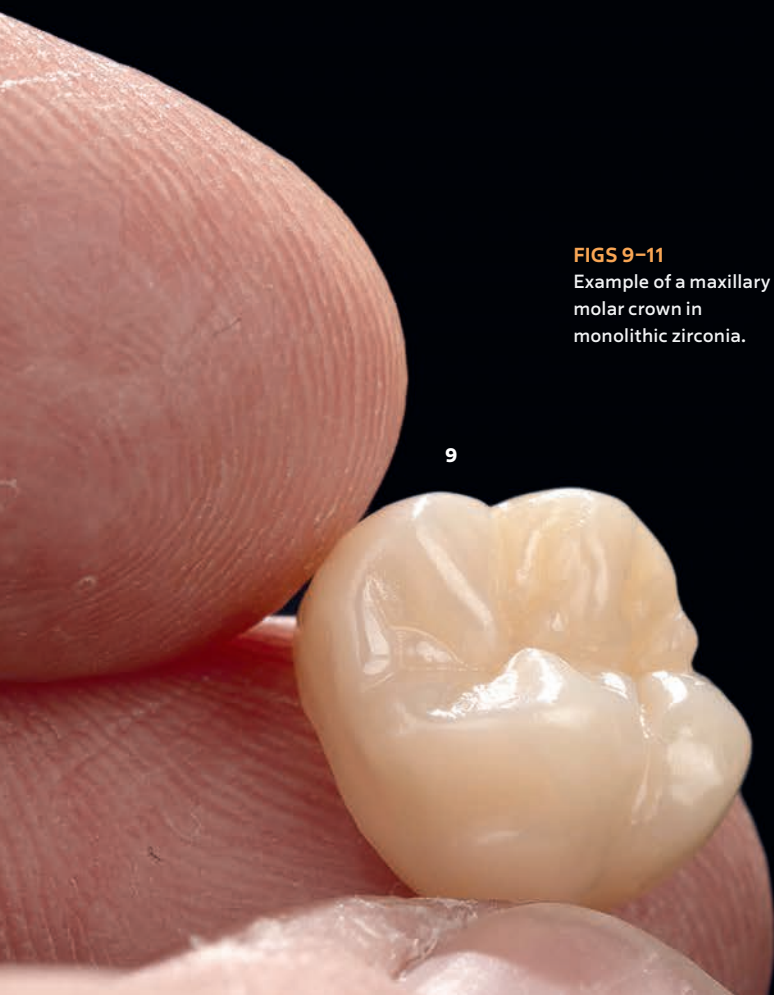
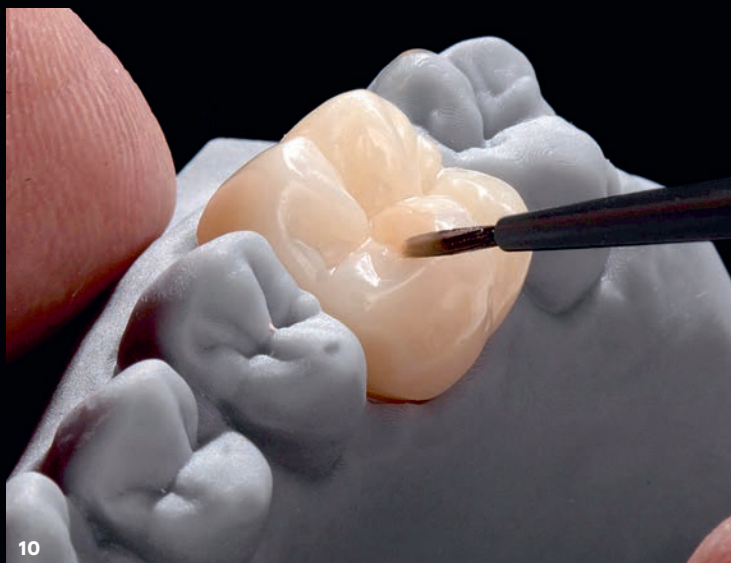
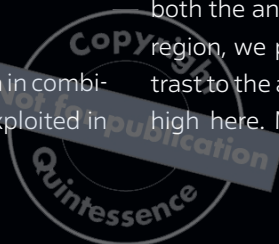
For us, microlayering is not just an alternative, it is the solution. As dental technology changes, one thing remains the same: the need for quality in both product and workmanship alike.



Posterior Applications

The performance of modern multilayer zirconia in combination with a microlayering ceramic can be exploited in

both the anterior and posterior regions. In the posterior region, we prefer a monolithic implementation. In contrast to the anterior region, the functional load peaks are high here. Monolithic zirconia restorations are consid-



FIGS 9–11
Example of a maxillary molar crown in monolithic zirconia.



ered the state of the art. Clinical experience and scientific studies confirm their long-term stability.

In our laboratory, we have found it useful for novice ceramists to start with posterior monolithic restorations

and the staining technique. The learning curve is short, and success is almost immediate. With sufficient practice, microlayering can later be performed with relative confidence (Figs 9 to 13).



FIGS 12/13

Four mandibular restorations: monolithic frameworks fabricated and finished by individual surface characterization.



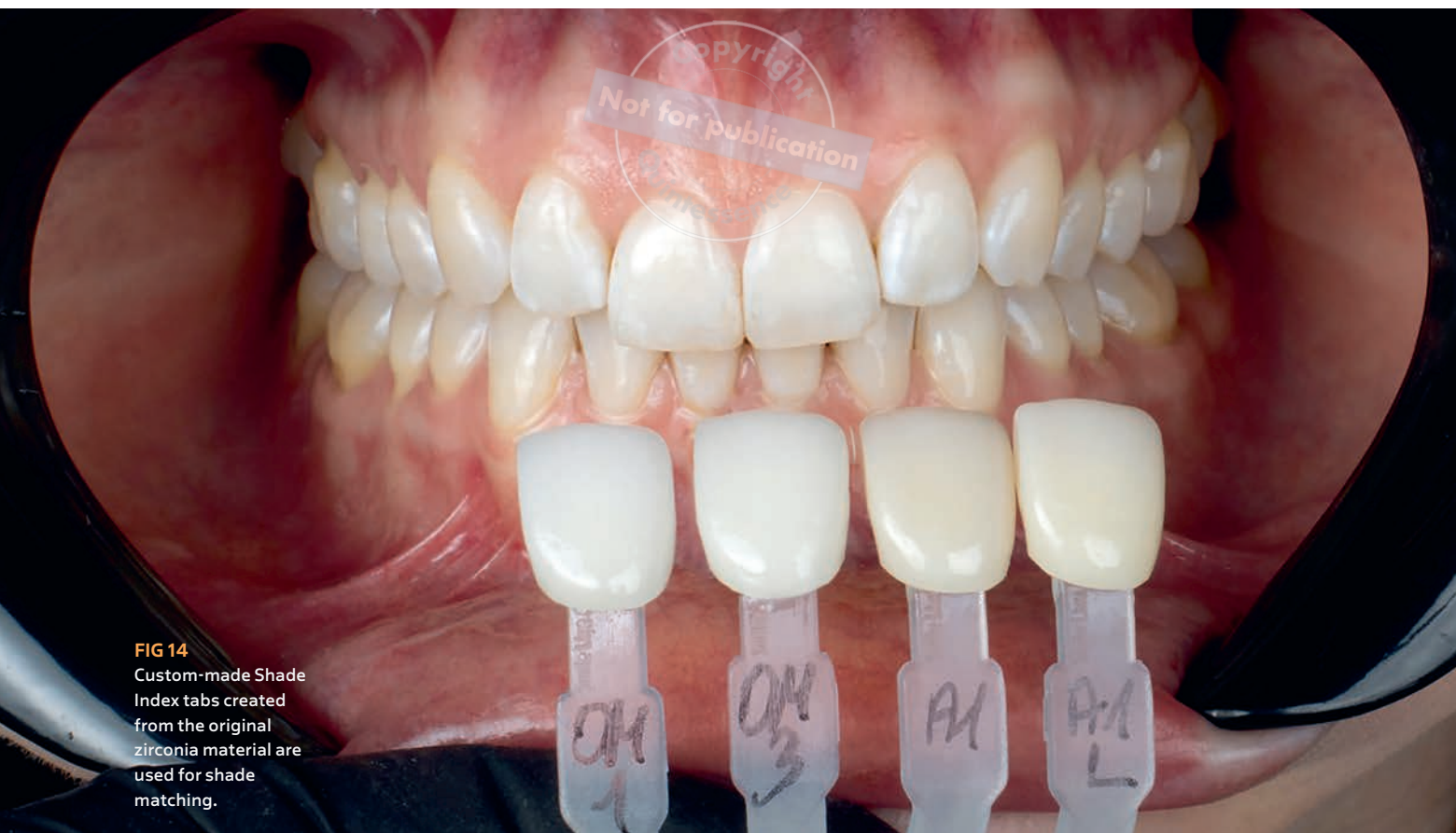


FIG 14
Custom-made Shade Index tabs created from the original zirconia material are used for shade matching.

Anterior Applications

In the anterior region, the choice of zirconia material is very challenging. In many laboratories, the classic VITA shade guide (VITA classical) is used as a reference. It is important to have such a uniform nomenclature for shade communication, which is also used for ceramic materials.

However, this is precisely where many multilayer zirconia materials reach their limits and dental technicians stumble. In some cases, there are large discrepancies between the classic shade guide and the specified zirconia shade. However, because in microlayering 80% to 90% of the shaping components are defined by the zirconia, such deviations cause real problems, including excessive translucency, a pronounced grayish tint, an unnatural color gradient, visible transitions, incorrectly positioned shade layers, and so on.

It is sobering to observe that many multilayer zirconia materials have virtually nothing in common with the shade reference (VITA shade guide). There seems to be little consistency in the parameters of zirconia

development between manufacturers. A truly everyday zirconia material should be able to reproduce each shade in the shade guide as closely as possible. When we look at the shade communication, it becomes clear where the stumbling blocks are and how to get around them.

Shade communication

We have established a dynamic color communication concept in our laboratory to help us select the right shade of zirconia. We work with a custom shade guide, our Shade Index.⁵ Producing a Shade Index is very simple. A crown is milled from the original zirconia (eg, ArgonZ HT+ Multilayer), sintered, and glazed without rework. Because each tooth has a different volume ratio, which affects the base shade, a separate Shade Index is created for anterior teeth, premolars, and molars. In this way, we get Shade Indexes to cover all situations (Fig 14).

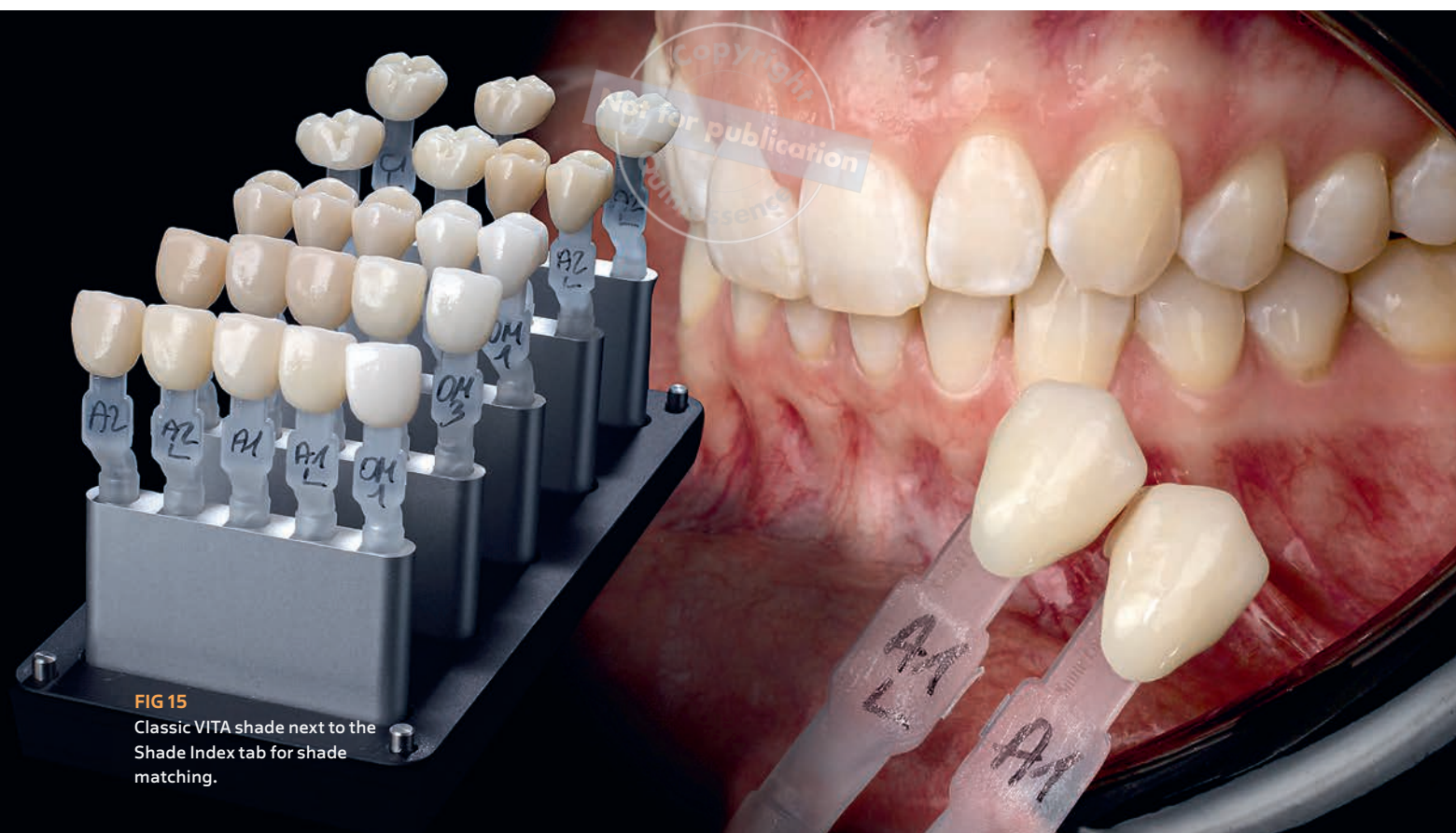


FIG 15
Classic VITA shade next to the
Shade Index tab for shade
matching.

Shade matching

To select the appropriate zirconia, the classic VITA shade guide is held next to the individual Shade Index to find a match (Fig 15). We have had good experience with ArgenZ HT+ Multilayer. With this material and proper shade matching, the zirconia base will most likely match the desired base shade.

When taking the shade in the patient's mouth, the well-known guidelines apply (neutral lighting environment, no clothing in intense colors, etc). Photographic documentation of the intraoral shade determination is essential. Good images can be obtained with the sophisticated cameras of modern smartphones. You should work under a calibrated light source (eg, Smile Lite, Smile Line). The photo is created with a classic shade guide and with the custom Shade Index tab for perfect shade matching.

A perfect match

To be able to select the correct base shade during shade matching, the zirconia portfolio must offer a sufficiently wide range of shades. ArgenZ HT+ Multilayer contains 25 different shades to help you find the perfect match. The zirconia combines seven layers along a smooth color gradient. Its opacity is sufficient to hide dark structures, yet its wonderful translucency is impressive. The layers are created with ideally matched mixing zones. In particular, the incisal transition layer makes the material special—translucency offsets are effectively bypassed.

Argen is one of the few manufacturers to adapt the layer distribution to the size of the ingots in the sheet. This means that with a 30-cm round ingot, for example, the gradients are so cleverly placed that a good result is achieved even with a high vertical dimension. Nasty surprises in shade reproduction are virtually unknown.

Figures 16 to 30 show how microlayer zirconia can be used beautifully for anterior single crowns.



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FIGS 16-30

Working example: microlayered anterior single crowns. Efficient and highly esthetic results can be achieved for multiple anterior teeth.

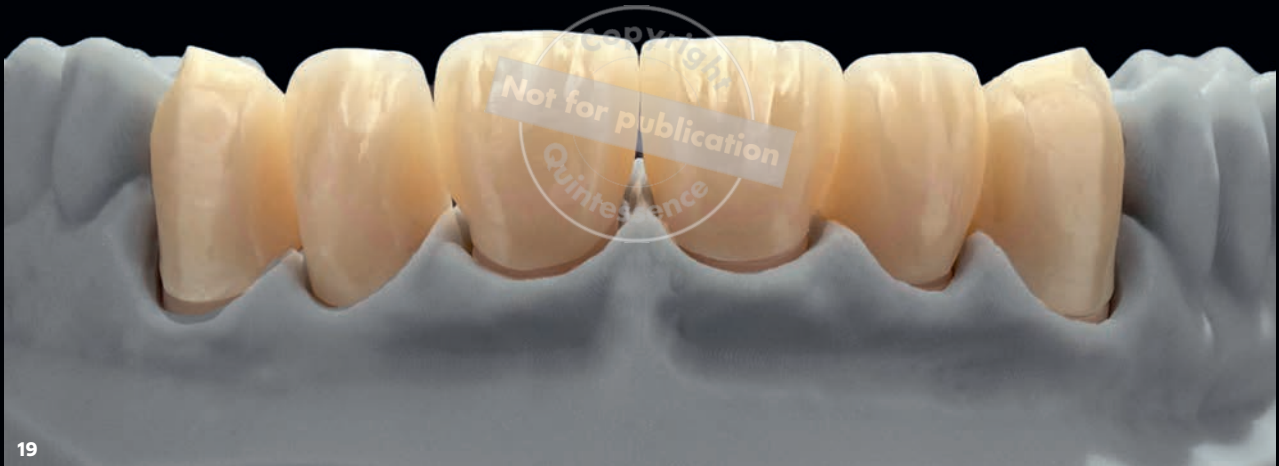
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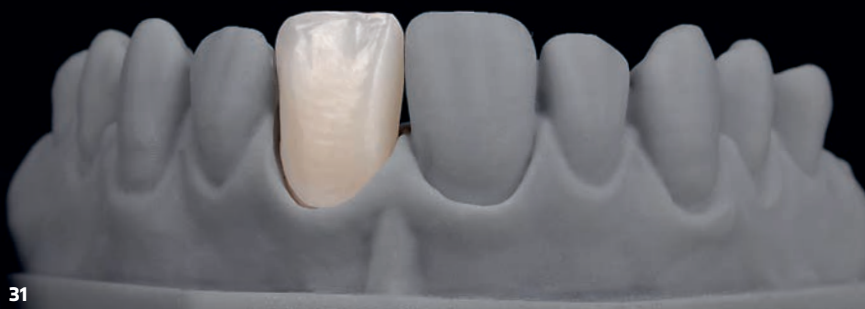


Single anterior teeth

We do not consider microlayering to be in competition with the classic art of layering. There is no debate as to whether microlayering achieves the same esthetic results as complex layering. Microlayering is a separate technique and must be considered separately.

While highly specialized ceramists have the freedom to play completely with the many nuances of all-ceramics and create beautiful, unique restorations, microlayering offers a simplified and reproducible conceptual path to an esthetic result.

However, the technique is not without limitations. The dental technician must be aware of these limitations in order to select the appropriate approach for each individual case (Figs 31 to 35).



FIGS 31–35 Microlayering is not a magic bullet. Especially in highly specialized situations like restoration of a single anterior tooth, ceramic layering based on dental technical skill and sensitivity is essential. Observe here a conventional crown with the GC Initial IQ ONE SQIN shade and shape concept: zirconia framework (multilayer), framework preparation (Lustre Pastes), thin veneer layer, and completed crown from different perspectives.





FIGS 36–43 Working example: microlayered crown. With a little experience, a correctly matched shade, and the appropriate materials, wonderful results can be achieved even for a single anterior tooth.

Conclusion

Safety, esthetics, and reproducibility—these terms only begin to describe the potential of this combination. I have been working with all-ceramics for more than 25 years, and I remember the time when veneers were considered the bottleneck of all-ceramic restorations.⁶ Zirconia has changed all that, and microlayering is the new standard. In principle, the success story of microlayering can only be continued with a modern framework material and a ceramic system adapted to the procedure. Let's review a few key points about microlayering:

- The basic shade of the restoration is determined by the zirconia. A 4Y-TZP multilayer zirconia (eg, ArgenZ HT+ Multilayer) is preferred.
- The shade match between the patient situation and the zirconia (Shade Index) determines the esthetic success.

- Optical effects are imitated on an ultrathin layer. A suitable ceramic concept (eg, GC Initial IQ ONE SQIN) is recommended.

Existing working procedures that have been used successfully for years should not be questioned. Rather, the aim is to raise awareness of the need to expand established concepts on the basis of current developments. Microlayering on multilayer zirconia, as a contemporary working concept, fills a gap in everyday all-ceramic practice. While boutique laboratories or highly specialized ceramists are able to meet almost any challenge with classic layering techniques using the finest craftsmanship, this concept offers the “normal” dental laboratory access to a manageable path to a highly esthetic result (Figs 36 to 43).



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Acknowledgments

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