Direct bonding in the smile frame
Merging new technologies and human touch for the best

By Dr Didier Dietschi, Switzerland

Introduction
Restorative dentistry has entered a phase of deep conceptual rupture, demarcating two camps, the traditional one, pursuing the convention of humans-conceived and fabricated restorations, and the modern one, celebrating new technologies in all aspects and steps of a restorative treatment and limiting tremendously the manual contribution of the dentist. However, even the most enthusiastic, modern professionals recognize that no technology can equate to the excellence and perfection of a powerful brain and agile hands acting in synergy, while the most conservative ones also admit that digital dentistry has the potential to elevate the level of mass dentistry. What is the most reasonable attitude? Probably a position in between the extremes. Freethand direct bonding can then be looked at from different perspectives as well: it will soon be abandoned and replaced by CAD/CAM and 3D printed restorations, or on the contrary, even further developed, using some new digital technologies to improve its outcome and practicability, fueled worldwide by a slowing economy and the quest for an ultraconservative, non foreseen new technology seems to continue, probably even develop, in the forthcoming decade. Actually, color integration as perceived by patients implies correct hue, opacity, opalescence and fluorescence regarding optical deter-
minants and surface gloss and light reflectance (mainly related to the restorative microanatomy). An optimal result in terms of esthetic integration is feasible today, although it will rarely be achieved without proper material choice and an appropriate layering concept and application, which are largely product-specific.

Overall considerations and indications for direct bonding
The use of composite is likely to continue, probably even develop, in the forthcoming decade. Actually, no foreseen new technology seems able to allow soon the intraoral fabrication of highly esthetic and strong restorations in a simple, efficient and cost-effective way. In the case of extraoral fabrication, tapered cavities or at least different cavity designs are required, generating as well undesired complications and costs. Keeping this in mind, direct composite application has some advantages in the following precise indications (Figs. 1a–e): Class III restorations, form corrections (tooth shape, proportions and dimensions), esthetic enhancements in young patients, diastema and black triangle clo-
sure; veneering of anterior and lateral sure; esthetic enhancements in young patients; limited-dimensional restorations; ––form corrections after orthodontic treatment as well. (Fig. 1f) The use of composite is likely to continue, probably even develop, in the forthcoming decade. Actually, no foreseen new technology seems able to allow soon the intraoral fabrication of highly esthetic and strong restorations in a simple, efficient and cost-effective way. In the case of extraoral fabrication, tapered cavities or at least different cavity designs are required, generating as well undesired complications and costs. Keeping this in mind, direct composite application has some advantages in the following precise indications (Figs. 1a–e): Class III restorations, form corrections (tooth shape, proportions and dimensions), esthetic enhancements in young patients, diastema and black triangle closure; veneering of anterior and lateral teeth; if limited-dimensional restorations; ––form corrections after orthodontic treatment as well. (Fig. 1f)

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The advantages of a direct approach are multifold, including tissue con-
servation, use in young patients (aiming for treatment reversibility), reduced execution time and lower cost (as opposed to indirect or CAD/ CAM restorations), providing also a satisfactory longevity.2 Conversely, some limits exist, related to the practitioner’s experience, composite shading and layering concept (some systems are still overcomplicated and unreliable in terms of esthetic/ shade outcome) and application of detailed protocols, although the last point orshortcoming is truly a rela-
tive one. The use of direct techniques has only few limitations, in terms of extent, namely nonvital teeth or very large carious lesions, for which crowns or extended bonded porcelain restora-
tions are usually preferred. Likely in between indications for direct or indirect solutions – some cases lie within a gray zone – are resolved mainly according to the operator’s preference rather than any other strong rationale (Figs. 2a–i).

Shading and layering concept
Overall, layering concepts evolved from a primitive approach to emulating natural dental anatomy and optical properties to more reliable protocols for matching tooth color and its many dimensions.5–7 Actually, color integration as perceived by patients implies correct hue, opacity, opalescence and fluorescence regarding optical deter-
minants and surface gloss and light reflectance (mainly related to the restorative microanatomy). An optimal result in terms of esthetic integration is feasible today, although it will rarely be achieved without proper material choice and an appropriate layering approach and application, which are largely product-specific. We normally classify composite systems in relation to the number of recommended layers, as well as some selected optical properties, which allow for finer differentiation among brands. In parallel, filler technology has considerably evolved, aiming to offer the practitioner various options, such as universal materials (supe-
rative hybrids or bi-
homogenous nanohybrid), which can be used for both posterior resto-
ration, owing to their excellent mechanical properties, wear resistance and esthetics, or specific composite formulations (spherical or mixed-filler composites) aimed to be used mainly in anterior teeth owing to lower mechanical performance. Our preference today is toward universal composites as far as material tech-
nology is concerned and a bilaminar application approach, considered simple, reliable and highly esthetic.

The use of the natural tooth as a source of inspiration.8, 9 It resulted in a comprehensive study of nat-
ural dentin and enamel optical prop-
erties, recognizing the variations in tissue quality related to tooth age and functional maturating. Related findings have logically drawn the lines of this new concept (Fig. 3).6–9 Spectrophotometric measurements (tristimulus L*a*b* color and opacity values) of natural teeth belonging to various VITA shade groups led to the conclusion that the use of distinct dentin colors for a direct composite restorative system could be avoided, provided that enamels would offer not only different value/opacity levels but also different tints. Likewise, limited natural dentin opacity with- in a given chroma level variation did not support the use of different den-
tin opacities (i.e., translucent, regular or opaque dentin).6–9, 11

Then, a new concept was born, allowing the emulation of practically all of the VITA shades by using an appropriate combination of universal dentin shades of a single opacity level and presenting a wide chroma range that extends beyond VITA classical shades and multi tint/multi-translucency enamels (typi-

Specific characteristics of NLC dentins and enamels
In summary, in an NLC compos-
it system, the specific material optical properties for dentin are a niche, a single opacity and an extended chroma range (Fig. 3). For enamel, three specific enamels types are needed: to mimic young enamel white tint and reduced translucency, adult enamel: neutral tint and inter-
mediate translucency, and elderly enamel: yellow tint and higher trans-

Effect shades
For teeth with richer color compos-
tion (strong opalescent halo, re-
teculable dentin mummies, enamel opacities, etc.), special effect shades produced in a flowable consistency are available in some NLS systems to sur-
pass esthetic boundaries (typical brand inspir). Case presentation
A patient, aged 16, presented with an aesthetic complaint, after orthodontic closure of spaces owing to missing lateral incisors. The functional and...
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a bilaminar shade guide (inspiro), which allows individual selection of dentin and enamel shades, emulating the natural disposition and thickness of dentin and enamel. Modern composite systems show a clear simplification of the shading concept, and improved practicability; a proper shade guide is a crucial tool to achieve optimal color integration of the future restoration.

Fig. 3: Further corrections, tissue conservation, cost-effectiveness and esthetics.

Figs. 2q–s: Views at 1.5 years post-treatment showing optimal behavior of the direct composite restorations. This treatment can be considered an optimal treatment option for young patients owing to the possibility of eliminating some re-treatment (Align Technology; Figs. 2c–f) to enhance the opalescence halo at the incisal edge. Finishing and polishing were performed using conventional discs and fine diamond burs (40 μ) for primary anatomy and a combination of two silicone instruments for polishing and high gloss (Identoflex Minipoint and HiLuster, KerrHawe), the curvatures of which help in recreating the natural convexity of proximal surfaces. The NLC of a bilaminar buildup approach was applied (Figs. 2j–m) with one dentin (Body 12, inspiro) and one enamel (SkinWhite, inspiro) shade. Small additional increments of effect shades (Azur and Ice, inspiro) were applied to emulate chromatic details and to obtain highly esthetic results. These findings supported the treatment option selected.

Conclusion
As said, the freehand application of composite is to remain and even likely to further develop, and we do not foresee new techniques challenging the simplicity and efficiency of direct composites. Actually, on one hand, 3-D intraoral printing of composite restorations with a high filler load seems unlikely to happen soon owing to the viscosity of such material, while on the other hand, extracorporeal fabrication would require a tapered cavity design with a significant, nonconservative alteration.

In short, there is not any technology that can replace direct composites yet. Having said that, achieving optimal forms, smile configuration and color is not so simple, and improved clinical protocols are needed to obtain highly esthetic results with direct bonding in a predictable manner. This is where existing technologies can make a significant contribution in the form of digital diagnostics (digital smile design) and 3-D printed mock-ups to support treatment planning, constrain clinical difficulties, and therefore expand the possibilities of direct bonding.

The next milestones in treatment reliability is the use of a highly effective and simple layering approach such as the NLC. The last two improvements in direct bonding application are keys to success for the modern practitioner, specialist or not.

Editorial note
A list of references is available from the publisher.

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