



Article professionnel

Article

2012

Published version

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How to cite

DIETSCHI, Didier, LAMPL, Stefan. Free-hand bonding : The ultimate treatment modality enhance smiles in young patients. In: Australasian dental practice, 2012, vol. janv/fév, p. 138–142.

This publication URL: <https://archive-ouverte.unige.ch/unige:32596>

Free-hand bonding: the ultimate treatment modality to enhance smiles in young patients

By Didier Dietschi, DMD, PhD and Dr Stephan Lampl



“Apart from classical indications such as class III, IV and V fillings, many aesthetic or functional deficiencies can be corrected by simple, direct composite restorations...”

A significant proportion of dental professionals and patients tend to think that ceramic restorations are to be considered as the main treatment option to achieve good aesthetics, function and durability. Composite resins today are challenging this position because they offer excellent aesthetic potential and acceptable longevity, with a much lower cost than equivalent porcelain restorations for the treatment of both anterior and posterior teeth.¹⁻³ In addition, composite restorations allow for minimally invasive preparations or no preparation at all when assuming the replacement of decayed or missing tissues. This thinking is part of a new concept called ‘bio-aesthetics’, giving priority to additive, minimally or microinvasive procedures to preserve tooth biology and biomechanics; although logical, this treatment approach’s potential still is underexploited.

Besides classical and well-accepted indications such as class III, IV and V fillings, many other aesthetic or functional problems can be corrected by simple direct composite restorations providing outstanding aesthetic and functional results (Figures 1-24).^{2,3} Recent developments in composite optical properties have definitely simplified application technique, positively impacting practicability, efficiency and predictability of the treatment outcome.⁴⁻⁶

The aim of this article and case report is to demonstrate the potential and multiple applications of composite as a modern aesthetic restorative material.

A new array of indications

The main issue when it comes to restoring a smile is whether we should consider a direct or indirect option; besides minor aesthetic corrections or extensive decay in non-vital teeth, a lot of cases lie within a “gray zone” where almost all possible techniques and materials can be considered. A simple yet effective approach to this dilemma after a comprehensive biological, functional and aesthetic diagnosis has been made, is to follow the treatment decision process shown in Table 1.

Apart from classical indications such as class III, IV and V fillings, many aesthetic or functional deficiencies can be corrected by simple, direct composite restorations; these indications include:

1. Post-orthodontic conditions:

Lateral incisor aplasia or incorrigible canine impaction are frequent findings often approached by an orthodontic solution; however, different anatomical, functional and aesthetic anomalies may result from the orthodontic approach. Other orthodontic conditions (i.e. tooth size discrepancy) can also lead to the persistence of diastemas or sub-optimal tooth position, despite an appropriate treatment. The increasing concern of our patients for aesthetics obliges the dental team to correct potential deficiencies such as unusual crown dimensions; unusual root diameter; unusual shape of the crown; difference in colour; or difference in gingival contour or level (Figure 2).



Figures 1-2. Preoperative views of a 16-year-old patient with front teeth hypoplasia and moderate fluorosis.



Figures 3-4. Completed smile rehabilitation using a "no-prep" ultra-conservative approach. This treatment option has obvious advantages due to the young age of the patient but it requires a precise clinical protocol to ensure satisfactory aesthetic and functional outcomes.

2. Congenital aesthetic deficiencies

Numerous congenital conditions, such as displasia/dyscolourations; hypoplasia; or unusual tooth forms or dimensions, require correction at a relatively early stage and therefore mandate a conservative approach (Figure 1).

3. Acquired and other aesthetic deficiencies

Several other conditions can develop at different ages which impact smile balance and aesthetics including discolourations (ie traumatised non-vital tooth); abrasion, abfraction and erosion lesions; tooth fractures; tooth movements; caries; and functional deficiencies. These conditions are also potential indications for conservative, additive procedures, according to preexisting tissue loss and functional status.

New shading approach: the natural layering concept

The creation of perfect direct restorations has been for long an elusive goal because of the imperfect optical properties of composite resins and complicated clinical procedures, due mainly to attempts to mimic shades and layering techniques of ceramic restorations. The use of the natural tooth as a model and the identification of respective dentine and enamel optical characteristics (tristimulus $L^*a^*b^*$ colour measurements and contrast ratio) has then been a landmark in developing better direct tooth coloured materials.⁷⁻⁹ The 'natural layering concept' is then a simple and effective approach to creating highly aesthetic direct restorations which has become a reference in the field of composite restorations.

Dentine optical features

Variations in a^* and b^* dentine values between 'A' and 'B' VITA shades seemed not to justify the use of distinct dentine colours, at least for a direct composite restorative system.⁹ Likewise, the

variations of the contrast ratio (opacity-translucency) within a single shade group did not support the use of different dentin opacities (i.e. translucent, regular or opaque dentins). However, a large chroma scale covering all variations of natural dentitions, plus some specific conditions like sclerotic dentin proved justified to meet all clinical conditions.

Table 1. Treatment decision process

Parameters	Direct option	Indirect option veneer ..to.. crown
age of the patient	younger	older
size of the decay	smaller	larger
tooth vitality	*** vital	*** non-vital
tooth colour	normal	non-treatable discolouration*
facial anatomy	normal	altered
number of restoration	unrelated	unrelated

*using chemical treatments (vital & non-vital bleaching or microabrasion)

Therefore, the ideal material aimed to replace dentin exhibits:

- single hue;
- single opacity; and
- large chroma scale (beyond the four chroma levels of the VITA system).

Enamel characteristics

As regards enamel, differences in tissue lightness and translucency proved generally to vary in relation with tooth age and therefore confirmed the clinical concept of these three specific enamel types¹⁰:



Figures 5-6. A wax-up was made and transferred to the mouth using a direct mock-up made with self-curing resin (Protemp Garant).



Figure 7. Shade recording made prior to rubber dam placement using a special dual shade guide, combining both dentin and enamel samples (Edelweiss Direct, Edelweiss dentistry); this step is simplified by the "Natural Layering Concept".



Figure 8. Rubber dam applied from premolar to premolar to provide a full-smile view, which is mandatory to allow the placement of the silicone index, as well as to visualize the full smile line during treatment.



Figure 9. A caliper along with the silicone index serves to monitor tooth dimensions, proportions and symmetry.



Figure 10. Central incisors are always restored first to establish midline and tooth axis; lateral teeth can then be modified with better control of anatomy and function.



Figure 11. The four incisors are completed; the new smile line is developing progressively. Here, both conventional bucco-lingual and centrifugal layering techniques were applied.

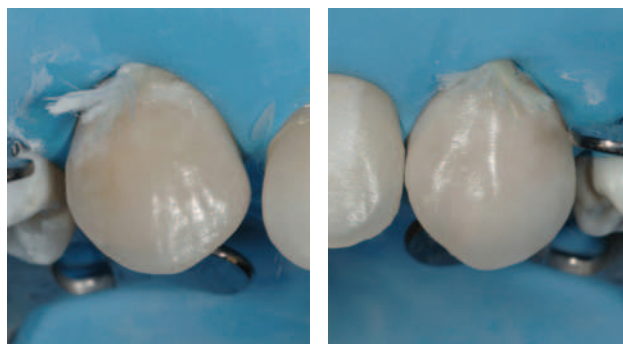
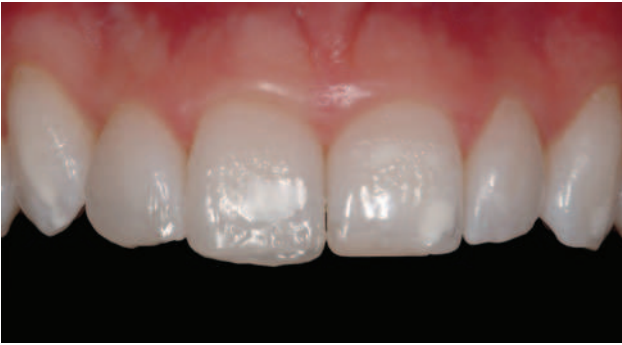


Figure 12-13. The reconstruction of both cuspids completes the treatment. However, due to the important space excess, small diastemas remain but are invisible in a frontal view. This was considered crucial to preserve adequate proportions and dimensions.



Figures 14-15. Preoperative view showing moderate wear, squarish forms and enamel hypocalcifications of both central and lateral incisors.



Figure 16. All enamel surfaces were sandblasted and etched while hypocalcifications were partially removed, leaving at least 1.25-1.5mm space for composite placement and colour correction.



Figure 17. A first dentin layer is applied which provides chroma correction (bodyi2, Edelweiss direct).



Figure 18. Thereafter enamel is applied to create an appropriate translucency and value (skin white, Edelweiss direct).



Figure 19. Interproximal contours are improved, using only an enamel shade.



Figure 20. All planned corrections were now performed; note that micromorphology and surface details are not developed by hand-instruments.

- Young enamel: white tint, high opalescence, less translucency;
- Adult enamel: neutral tint, less opalescence and intermediary translucency; and
- Old enamel: yellow tint, higher translucency.

Typical brand names are Edelweiss direct (Edelweiss Dentistry), Miris and Miris2 (Coltene Whaledent), Ceram-X duo (Dentsply) and Enamel HFO/HRI (Micerium).

Layering technique and clinical application

Composites can be applied following different incremental techniques for aesthetic or practical reasons as well as for better management of polymerization stresses.¹¹⁻¹³ For advanced cases, a modification of the classical centrifugal technique is needed, which

is the linguo-buccal technique. It makes use of a silicone key made from either a free-hand (simple cases) or wax-up (advanced cases) mock-up (Figures 5-6). It provides the anatomical and functional references required for an optimal aesthetic result, mimicking colour, translucency, opalescence and halo effects.

The aforementioned techniques allow a precise 3D placement of composite masses, what is considered crucial to the final treatment outcome. Last but not least, a methodical and gentle finishing and polishing technique will give the restoration its final beauty. The natural layering concept has then enabled this objective to be achieved in a much more predictable way, helping a larger number of our patients to receive conservative and highly aesthetic restorations.



Figure 21-22. Post finishing and polishing, we can visualize a slight but normal difference between the freshly applied composite and dehydrated dental tissues.



Figure 23-24. Post-operative view showing significant smile enhancement through non invasive and minimally-invasive adhesive techniques.

Conclusion

Traditional restorative objectives have not changed over time; they were simply implemented by the aesthetic demands of an increasing number of patients as well as by new forms of pathologies. Composite techniques have benefited from advances in their optical characteristics, such as the “Natural Layering Concept”, enabling more predictable aesthetic results to be achieved for all forms of anterior indications. Then, application techniques were refined and made possible the use of composite where we previously would only consider more invasive prosthetic solutions.

Composite techniques undoubtedly gained maturity and offer a wide range of successful applications; however, it remains our duty to select their indications with proper judgment without exaggerating or neglecting their many advantages and qualities. And last but not least, one should never forget that dedication and meticulous handling remain the keys to success... whatever the selected technique is.

About the author

Dr Didier Dietschi was licensed in 1984 and received his doctoral and Privat Docent degrees in 1988 and 2003, respectively, at the University of Geneva, Switzerland. He also received a PhD in 2003 at the University of ACTA, Netherlands. Following a 6-year period of full time teaching and research activity in Operative Dentistry and Periodontology, he started a part-time private practice in Geneva. He now holds positions of adjunct Professor at CASE Western University (USA) and senior lecturer at the University of Geneva. Dr Dietschi has published more than 75 clinical and scientific papers and book chapters on adhesive and aesthetic restorations and co-authored the book “Adhesive Metal-free Restorations”, edited in 1987 by Quintessence.

Dr Dietschi will present the “The A-P of Composite Resins” at the Amora Jamison Hotel, Sydney on April 20-21, 2012 plus an Anterior Composite workshop on April 22 and Posterior Composite workshop on April 23. For info, see www.adacpd.com.au.

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