CURRENT STATUS & FUTURE PERSPECTIVES FOR THE USE OF COMPOSITE RESINS IN THE Smile Frame

Methods Following the "Bio-Esthetic Concept"

Didier Dietschi, DMD, PhD

Abstract

The use of composites in the smile frame has evolved and gained maturity. However, ceramics remain the preferred esthetic option for many clinicians because direct bonding techniques are still considered intricate, sensitive and, to a certain extent, unpredictable. These drawbacks, essentially related to the complexity of former composite systems and their application methods, can be overcome today. Among the many improvements achieved through newer technologies and obvious refinements of clinical protocols, one can mention the effective use of composite to treat more complex esthetic deficiencies and tooth wear. The rejuvenation of composite prefabricated veneers is another example of the recent ways explored to further implement the successful indications of composite resins in the context of "bio-esthetics," to be considered as a modern philosophy of esthetic restorative dentistry with strong focus on biomechanics and biology. This article reviews some of the most prominent and current successes of adhesive dentistry.

CE CREDIT

Learning Objectives:
After reading this article, the participant should be able to:

1. Recognize the parameters that guide the clinician toward direct or indirect restorations.
2. Be aware of the main restorative sequence for the treatment of wear due to abrasion, attrition, erosion, or parafunction (bruxism).
3. Understand the main indication for prefabricated composite veneers versus porcelain veneers.

"The rejuvenation of composite prefabricated veneers is another example of the recent ways explored to further implement the successful indications of composite resins in the context of "bio-esthetics"..."

Introduction

Composite resins occupy a paramount position among restorative materials today because they offer excellent esthetic potential and acceptable longevity, with a much lower cost than equivalent ceramic 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-esthetics," giving priority to additive, minimally, or micro-invasive procedures to preserve tooth biology and biomechanics. Although logical, this treatment approach's potential still is under-exploited.

There are three areas of particular interest as it comes to the present and future use of composite resin in the smile frame, which are the classical freehand bonding, the use of adhesive techniques for the functional and esthetic rehabilitation of patients with severe tooth wear and, last but not least, veneering techniques. Besides classical indications such as Class III, IV, and V fillings, many other esthetic or functional problems can be corrected by simple, direct composite restorations providing satisfactory and fully documented short- and medium-term behavior **(Figs 1a-1c)**.[2,3] Actually, recent developments in composite optical properties have definitely simplified application technique, positively impacting practicability, efficiency, and predictability of the esthetic treatment outcome.[4-6] Next to this traditional and main indication field for composite resins, the increasing incidence of tooth wear due to erosion and attrition phenomenon has called the profession to develop new, interceptive restorative solutions that meet patients' esthetic needs as well as functional, biological, and biomechanical requirements.[7,8] Composite resins were also used practically since their conception as a cosmetic, veneering material; however, despite the obvious promise of this method

Figure 1a: Pre-treatment image of a 50-year-old patient with lateral incisor aplasia and subsequent diastemas and front teeth misalignment.

Figure 1b: Smile following a "no-prep" treatment, consisting of additive freehand composite correction (Miris 2, Coltène/Whaledent).

Figure 1c: The patient after four and a half years, showing the satisfactory behavior of modern resin composites, even when used in rather extensive restorations.

Parameters	Direct Option	Indirect Option
Age of Patient	younger	older
Size of Decay	smaller	larger
Tooth Vitality	vital	non-vital
Tooth Color	normal	non-treatable* discoloration
Facial Anatomy	normal	altered
Number of Restorations	unrelated	unrelated

Table 1
*using chemical treatments (vital and non-vital bleaching or microabrasion)

in terms of cost and tissue conservation, it proved technique-sensitive and time-consuming, potentially leading to disappointing esthetic results if not meticulously applied. Recently, the idea of prefabricated composite veneers was rejuvenated, taking advantage of modern technologies.[9] This can be regarded as one of the first attempts to use in the smile frame a "noble" composite system, free of all possible material imperfections such as bubbles, insufficient curing or polishing, or even surface contamination by modeling resins, to mention only the most frequent ones. Here, a molding process under heat and pressure enabled the fabrication of high-quality but inexpensive dental restorations, which represent an attractive alternative to direct composite veneers.

This article presents three features of particular interest and confirms the various applications of composite as a modern restorative and esthetic dental material. They are:

- esthetic freehand restorations
- comprehensive functional and esthetic rehabilitations in patients with tooth wear
- prefabricated composite veneers.

Composite and Freehand Bonding

The main issue when it comes to restoring a smile is whether we should consider a direct or indirect option; besides minor esthetic corrections or extensive decays in non-vital teeth, many cases lie within a "gray zone" where almost all possible techniques and materials can be considered. A simple, yet effective approach to this dilemma is to use the decision process shown in **Table 1**, after a comprehensive biological, functional, and esthetic diagnosis

Apart from classical indications such as Class III, IV, and V fillings, many esthetic or functional deficiencies can be corrected by simple, direct composite restorations; these indications are reviewed below.

Indications

Post-Orthodontic Conditions

Lateral incisor aplasia or incorrigible canine impaction are frequent findings that often are approached by an orthodontic solution; however, different anatomical, functional, and esthetic anomalies may result from the orthodontic approach. Other orthodontic conditions (e.g., tooth size discrepancy) can also lead to the persistence of diastemas or sub-optimal tooth position, despite an appropriate treatment. Our patients' increasing concern for esthetics obliges the dental team to correct potential deficiencies such as unusual crown dimensions, unusual root diameter, unusual shape of the crown, difference in color, and difference in gingival contour or level **(Figs 1a-1c)**.

Congenital Esthetic Deficiencies

Numerous congenital conditions, including dysplasia/discolorations, hypoplasia, and unusual tooth forms or dimensions, require correction at a relatively early stage and therefore mandate a conservative approach **(Figs 2a-2m)**.

Acquired and Other Esthetic Deficiencies

Several other conditions that impact smile balance and esthetics can develop at different ages. These include discolorations (i.e., traumatized non-vital tooth); tooth movement; abrasion, abfraction, and erosion lesions; tooth fractures; caries; and functional deficiencies **(Figs 3a-3l)**. These conditions are also potential indications for conservative, additive procedures, according to preexisting tissue loss and functional status.

A New Shading Approach: The Natural Layering Concept

The creation of perfect direct restorations has long been an elusive goal because of the imperfect optical properties of composite resins and complicated clinical procedures, due mainly to the attempt to mimic shades and layering techniques of ceramic restorations. The use of the natural tooth as a model and


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


Figures 2c & 2d: A wax-up made to evaluate foreseen enhancements using a direct mock-up, with self-curing resin (Protemp Garant, 3M ESPE; St. Paul, MN).

Figure 2e: Shade recording made prior to rubber placement, using a special dual shade guide, combining both dentin and enamel samples (Edelweiss Direct); this step is simplified by the "Natural Layering Concept."

Figure 2f: 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 2g: A caliper serves, along with silicone index, to monitor tooth dimensions, proportions, and symmetry.

Figure 2h: 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.

"Besides classical indications such as Class III, IV, and V fillings, many other esthetic or functional problems can be corrected by simple, direct composite restorations providing satisfactory and fully documented short- and medium-term behavior."

Figure 2i: The four incisors are completed; the new smile line is developing progressively. Here, both conventional bucco-lingual and centrifugal layering techniques were applied.

Figures 2j & 2k: 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 2l & 2m: Completed smile rehabilitation, again using a "no-prep," ultra-conservative approach. This treatment option has obvious advantages due to the young age of the patient. However, it requires a precise clinical protocol to ensure satisfactory esthetic and functional outcomes.

the identification of respective dentin and enamel optical characteristics (tristimulus L*a*b* color measurements and contrast ratio) have been landmarks in developing better direct tooth-colored materials.[10-12] The "natural layering concept" is a simple and effective approach to creating highly esthetic direct restorations that has become a reference in the field of composite restorations.

Dentin Optical Features

Variations in a* and b* dentin values between A and B VITA shades seemed not to justify the use of distinct dentin colors, at least for a direct composite restorative system.[12] 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 such as sclerotic dentin, proved to meet all clinical conditions.

Therefore, the ideal material aimed to replace dentin exhibits the following characteristics:

- single hue
- single opacity
- 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 types:[13]

- young enamel: white tint, high opalescence, less translucency
- adult enamel: neutral tint, less opalescence, intermediate translucency
- old enamel: yellow tint, higher translucency.

Typical brand names include Edelweiss Direct (Edelweiss Dentistry; Hörbranz, Austria), Miris and Miris 2 (Coltène/Whaledent; Cuyahoga Falls, OH), Ceram•X duo+ (Dentsply; York, PA), and Enamel HFO/HRi (Micerium S.p.A.; Avegno, Italy).

Layering Technique and Clinical Application

Composites can be applied following different incremental techniques for esthetic or practical reasons, as well as for better management of polymerization stresses.[14-16] For advanced cases, a modification of the classical centrifugal technique is needed, the linguo-buccal technique. It makes use of a silicone key made from either a freehand mock-up (simple cases) or wax-up (advanced cases) **(Fig 2c)**. It provides the anatomical and functional references required for an optimal esthetic result, mimicking color, translucency, opalescence, and halo effects.

The aforementioned techniques allow a precise three-dimensional placement of composite masses **(Figs 2f-2k)**. Last but not least, a methodical, gentle finishing and polishing technique will give the restoration its final beauty. The natural layering concept enables this objective to be achieved in a much more predictable way, helping a larger number of our patients to receive conservative and highly esthetic restorations **(Figs 2l & 2m)**.

Composite and Conservative Adhesive Restorations for Early Intervention on Severe Tooth Wear

Excessive abrasion (attrition) and erosion are two common "diseases" of dental hard tissues, which affect an increasing number of patients.[7,8] They can be considered as a growing challenge in dentistry, because with such patients and severe parafunctions, the etiology can rarely be successfully and permanently eliminated.[17-19] It therefore implies continuous monitoring to control related pathologies. The most frequent causes of erosion are unbalanced dietary habits with high consumption

of acidic foods/beverages as well as abnormal intrinsic acid production such as in bulimia nervosa, acid regurgitation, and hiatal hernia. Insufficient saliva flow rate or buffer capacity and, in general, saliva composition changes induced by various diseases, medications, and aging are other etiological co-factors.[20-23] As regards abrasion/attrition, awake and sleep bruxisms are two different forms of parafunctional activities that can severely impact tooth integrity;[17-19] preventive and restorative measures are therefore mandatory to correct and limit the extent of further tissue and restoration destruction. An important clinical finding is that a large number of patients concerned with hard tissue loss present combined etiologies, challenging the dental team to develop a multifactorial preventive and restorative approach.

Symptoms or complaints reported by patients include a shortening of teeth, discolorations, tooth displacement, dentin sensitivity and, finally, an increased risk for decay and premature loss of restoration marginal adaptation **(Figs 3a-3d)**. Due to the significant impact of tooth wear on occlusion, function, and esthetics, patients seek advice and intervention. The biomechanical challenge involves different specialties, starting with preventive measures and ending with full-mouth rehabilitation; intermediate stages (slight to moderate erosion/abrasion), however, require other clinical measures, such as various forms of adhesive, and partial restorations, which have the potential to restrict ongoing tissue destruction and restore function and esthetics **(Figs 3e-3l)**.[24-27]

A Comprehensive Treatment Approach

The modern approach to the treatment of tooth wear aims to stop the progression of disease before a full prosthetic rehabilitation is needed, implying large amounts of additional tooth substance to be removed with known potential biological complications[28,29] and rather inadequate biomechanical rationale. A modern treatment model involves three steps:

1) A comprehensive etiological clinical investigation, including diet analysis and identification of general/medical and local risk factors.
2) Treatment planning and execution, including proper functional and esthetic wax-up defining the new smile line and tooth anatomy, transferred then to the mouth with a combination of adhesive direct and indirect restorations.
3) A maintenance program, including protective nightguard wear and potential repair or replacement of restorations over a medium or long-term time frame **(Figs 3a-31)**.

> Composites can be applied following different incremental techniques for esthetic or practical reasons, as well as for better management of polymerization stresses.

Treatment Outline and Restorative Options

Increasing the vertical dimension of occlusion is in fact a key parameter to reversing the consequence of pathological wear and erosion.[29-34] Actually, the passive eruption that accompanies the continuous tissue destruction and loss tremendously restricts the space available for restorations, which due to their limited thickness would be very fragile or otherwise should invade unnecessarily residual tooth structure. Recent clinical reports have largely validated this treatment rationale **(Figs 3a & 3b, 3k & 3l)**.[32-34]

The therapeutic scheme is also logically oriented toward re-establishing first a proper central incisor length and anterior guidance, governing thereafter the new vertical dimension of occlusion (VDO). The proper anterior tooth anatomy and function is designed according to objective esthetic guidelines, existing and former tooth anatomy, and functional and phonetic components. The first step is made on study casts in the form of a partial (moderate posterior tissue loss) or full-mouth wax-up (advanced generalized tooth wear/erosion) **(Figs 3e & 3f)**. The optimal restorative choice is usually based on pre-existing dental conditions (presence of decay, restorations, vital or non-vital status) as well as the amount and localization of tissue loss. This means that various restorative options have to be considered and that treatment planning is highly individual (tooth-specific).

Direct composite. The direct composite option is logically indicated for all forms of moderate to intermediate tissue loss/destruction. Among other benefits of direct composite, one can cite the highly conservative approach, the possibility to replace/re-shape small portions of the tooth, the repairability the simplified replacement, and relatively limited cost. Conversely, it is more technique-sensitive and might create thin layers of material over some surfaces, which are mechanically "at risk." When using a sculpting technique, a correct anatomy can also be created with a direct technique, favoring the selection of a "firm consistency," highly filled material **(Figs 3g & 3h)**.[35-37]

Indirect composite. The indirect option is logically preferred when larger restorations or more severe tissue destruction are present. It also provides more control of anatomy and occlusion in complex or advanced cases. Nevertheless, one should not neglect the direct option only in favor of these later parameters, in consideration of the fact that occlusion seems not to play a major role in the origin of parafunctions.[18,19,38-40] Since direct and indirect techniques can be used together to treat the same patient, the indirect restorations have to be fabricated first, at the new VDO, and then direct composites placed.

Figures 3a & 3b: Preoperative images of a patient showing irregular smile line due to attrition of anterior teeth in relation to a deep bite and sleep bruxism.

Figures 3c & 3d: Parafunctional movements are mainly of a protrusive nature, as revealed by clinical evaluation of posterior teeth that show little wear.

Figures 3e & 3f: Due to the occlusal context and limited loss of hard tissue in the posterior areas, only an anterior wax-up was prepared to define the new VDO and an appropriate space for restoring anterior teeth.


Figures 3g & 3h: Intra-operative view of mandibular posterior teeth showing the new occlusal anatomy created by direct composite restorations.


Figures 3i & 3j: The choice was made to restore/reshape only the mandibular teeth because of the supra-eruption of anterior mandibular teeth. This approach aimed to reduce the overbite and, at the same time, provided the space needed to restore esthetic and functional maxillary anterior teeth.

Figure 3k. Maxillary anterior teeth following the correction of the smile line made with direct composites, after VDO correction.

Figure 3l. The restored smile three years after treatment, showing no sign of recurrent wear or mechanical degradation; the patient wears a nightguard regularly.

Parameters	Partial Facial Coverage	Full Facial Coverage (Veneers)
Size of Decay	smaller	larger
Tooth Color	normal	non-treatable* discoloration
Facial Anatomy	normal	altered
Number of Restorations	unrelated	unrelated

Table 2
*using chemical treatments (vital and non-vital bleaching or microabrasion)

Longevity of Restorations Placed to Correct Severe Tooth Wear and Erosion

Clinical studies have shown that the performance of composite to treat advanced tooth wear is adequate and that partial fractures represent the most likely complication, which can be corrected by a repair or uncomplicated restoration replacement.[41-43] The 10-year survival rate of porcelain-fused-to-metal (PFM) crowns proved slightly superior to composite restorations, but with much more severe complications. Actually, PFM failures led mainly to endodontic treatments or also to extractions, while composite failures/fractures could be either repaired or replaced.[43] This again is why the conservative and adhesive approach is favored in all kinds of initial-to-moderate forms of tooth wear and erosion.

Composite for Prefabricated Veneers: The Technique Rejuvenated

Historical Perspectives and Development

While the concept of veneering anterior teeth was presented in 1937 by Dr. Charles Pincus,[44] it became more popular in the mid-1970s, using three different approaches: direct bonding using resin composites; prefabricated composite veneers; and indirect, custom-made porcelain veneers.[45,46] The prefabricated composite veneer (Mastique, Caulk; Milford, DE) was explored about 35 years ago, using a methyl-methacrylate matrix and large glass fillers, such as those used in resin composites,[47] but with limited success due to technological limitations and poor surface qualities.[48] The rapid loss of surface gloss and surface degradation of prefabricated resin veneers linked to some interfacial defects led the system to be soon abandoned and definitively replaced by bonded porcelain veneers, which also had the advantage of an individual fabrication process.[49,50]

The concept of prefabricated composite veneers was, however, recently revitalized, taking advantage of new technologies:[9] the Direct Venear system (Edelweiss Dentistry and a planned partnership with Edelweiss by Ultradent; South Jordan, UT), was recently launched and is based on high-pressure molding and heat-curing processes, followed by laser surface vitrification **(Figs 4a-4g)**. This enables the veneers to exhibit a hard and glossy surface **(Figs 4c & 4f)**, with a texture to fit the majority of dentitions. The system is actually designed to facilitate the esthetic restoration of decayed or discolored single and multiple anterior teeth.

Indications

The aforementioned direct composite veneer system does not aim to systematically replace the well-established individualized porcelain veneer technique. Rather, it offers an alternative to directly (or freehand) built-up composite veneers, which is a delicate and time-consuming technique. As it comes to define the clear demarcation between partial and full coverage, the selection process might be facilitated by the clinical parameters noted in **Table 2**.

Composite prefabricated veneers present an obvious potential in the following indications:

1) For single facial restorations **(Figs 4a-4g)**:
- large restorations/decays with loss of natural tooth buccal anatomy/color
- non-vital, discolored teeth
- traumatized, discolored teeth (without endodontic treatment)
- severe/extended tooth fracture
- extended tooth dysplasia or hypoplasia.

2) In full-smile facial rehabilitations **(Figs 5a & 5b)**:
- moderate to severe discolorations (i.e., tetracycline staining and fluorosis)
- generalized enamel hypoplasia/dysplasia (i.e., amelogenesis imperfecta IIIA)
- large serial restorations/decay with loss of natural tooth buccal anatomy/color
- attrition of incisal edges (after proper occlusal and functional management)
- financial limitations
- young patients with immature gingival profile.

In fact, the aforementioned indications cover the accepted application field of "traditional" veneers, while other mere cosmetic indications are to be considered controversial with this technique. Actually, this veneering system is micro-invasive (minimal tooth

preparation is mandatory); it should not be considered for the esthetic enhancement of virgin, healthy teeth. But when properly indicated and applied, the advantage of this "different" veneering approach is a relatively cost-effective and straightforward solution featuring a "one-appointment" treatment. Likewise, this new, alternative treatment option falls fully under the aforementioned "bio-esthetic concept."[11]

Clinical Application

The case preparation for prefabricated composite veneers does not differ from other functional and esthetic treatments. First comes bleaching of neighboring teeth and/or antagonist arch, followed by replacement of all defective Class III, IV, and IV fillings. The veneering treatment per se involves four main steps: tooth preparation, veneer adjustment, adhesive procedures (on tooth and veneers), followed by cementation **(Figs 4b-4e)**. For cementation, either a dentin or enamel shade can be used, depending on the desired final shade.

This "rejuvenated" technique does not, however, replace conventional "custom-made" ceramic veneers, but rather allows clinicians to offer patients a one-visit, cost-effective alternative to directly (or freehand) built-up composite veneers. This system may also allow clinicians to fill in gaps within their treatment armamentarium with obvious and interesting application potentials, such as the treatment of young patients with localized or generalized hypoplasia/dysplasia or discoloration; and in general when a long-term temporary and highly esthetic solution is needed. With the exception of the need for a meticulous adaptation of the cervical profile and possibly the proximal and incisal edges, the overall preparation and cementation procedures are for the most part very similar to those for indirect porcelain veneers or composite inlays and onlays. Another advantage for both the patient and the dental team is, of course, that no temporaries are needed.

Conclusion

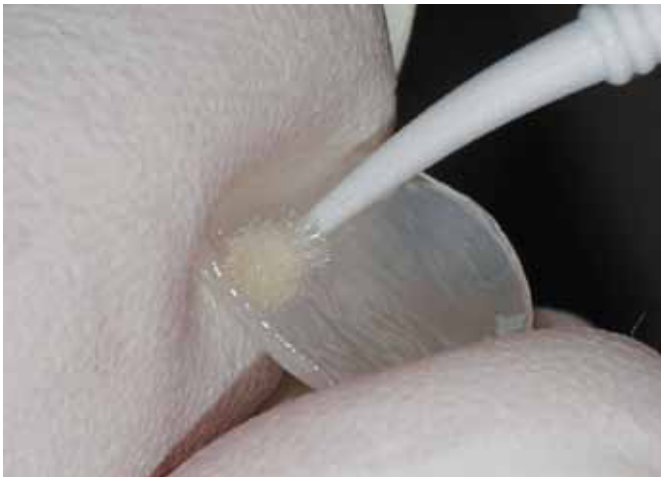
Traditional restorative objectives have not changed over time; they were simply implemented due to the esthetic demands of an increasing number of patients as well as new forms of pathologies. Composite resins then became the material of choice for young patients and cost-conscious patients, or all those who require a strictly conservative approach. These indications embrace highly conservative cosmetic enhancements to comprehensive functional and esthetic rehabilitation of patients suffering from severe tooth wear. We are now also exploring new types of restorations such as prefabricated veneers made of enhanced composite materials.

Composite techniques have benefited from advances in their optical characteristics, such as the "Natural Lay-

Figure 4a: Initial view showing a severely discolored left incisor, which had not improved despite extended bleaching. Due to the patient's financial limitations, a chair-side prefabricated composite veneer was selected (Edelweiss Venear).

Figure 4b: A preparation slightly deeper than usual (micro-invasive) is mandated by the dental substrate darkness.

Figure 4c: Set of veneers showing a very smooth and shiny surface, resulting from surface vitrification.



Figures 4d & 4e: The veneers needed to be adapted in different zones (cervical, proximal, and incisal) in order to follow the preparation outline. Conventional adhesive procedures (sand-blasting, priming, and bonding) were performed on the veneers' internal surfaces.

Figures 4f & 4g: Postoperative views of both central incisors restored during a single session; the advantage of these prefabricated composite veneers are numerous. They provide an ideal tooth anatomy, a high restoration gloss (due to laser vitrification), and reduced treatment time.

ering Concept," enabling more predictable esthetic 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 have considered more invasive prosthetic solutions. Finally, the rejuvenation of the "old" concept of prefabricated veneers has again expanded our treatment options; even though this later option does not replace conventional "custom-made" ceramic veneers, it offers a one-visit, cost-effective alternative to direct (freehand) composite veneers and is probably one of the first attempts to use "noble" composite resins, with obvious physical and clinical advantages.

Composite techniques undoubtedly have matured 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….no matter what the selected technique is.

Acknowledgment

The author thanks Stephan Lampl, BChD, MDT (Edelweiss Dentistry), for providing the images of the case presented in Figures 4 and 5.

Figure 5a: Preoperative view of a patient showing severe tooth wear.

Figure 5b: Following the necessary occlusal anatomy and function changes, this patient's front teeth were restored with heat-pressed, laser-vitrified composite prefabricated veneers.

> "Composite techniques undoubtedly have matured 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."

References

1. Macedo G, Raj V, Ritter AV. Longevity of anterior composite restorations. J Esthet Restor Dent. 2006;18:310-1.

2. Peumans M, Van Meerbeek B, Lambrechts P, Vanherle G. The 5-year clinical performance of direct composite additions to correct tooth form and position. II. marginal qualities. Clin Oral Investig. 1997;1(1):19-26.

3. Peumans M, Van Meerbeek B, Lambrechts P, Vanherle G. The 5-year clinical performance of direct composite additions to correct tooth form and position. I. esthetic qualities. Clin Oral Investig. 1997;1(1):12-8.

4. Dietschi D, Ardu S, Krejci I. A new shading concept based on natural tooth color applied to direct composite restorations. Quintessence Int. 2006;37:91-102.

5. Magne P, So WS. Optical integration of incisoproximal restorations using the natural layering concept. Quintessence Int. 2008;39:633-43.

6. Dietschi D. Optimizing smile composition and esthetics with resin composites and other conservative esthetic procedures. Eur J Esthet Dent. 2008;3:14-29.

7. Van't Spijker A, Rodriguez JM, Kreulen CM, Bronkhorst EM, Bartlett DW, Creugers NH. Prevalence of tooth wear in adults. Int J Prosthodont. 2009;22(1):35-42.

8. Lussi A, Jaeggi T. Erosion––diagnosis and risk factors. Clin Oral Investig. 2008 Mar;12 Suppl 1:S5-13.

9. Dietschi D, Devigus A. Prefabricated composite veneers: historical perspectives, indications and clinical application. Eur J Esthet Dent. 2011;6:178-87.

10. Cook WD, McAree DC. Optical properties of esthetic restorative materials and natural dentition. J Biomat Mat Res. 1985;19:469-88.

11. Dietschi D, Ardu S, Krejci I. Exploring the layering concepts for anterior teeth. In: Roulet JF, Degrange M, editors. Adhesion: the silent revolution in dentistry. Hanover Park (IL): Quintessence Pub.; 2000. p. 235-51.

12. Dietschi D, Ardu S, Krejci I. A new shading concept based on natural tooth color applied to direct composite restorations. Quintessence Int. 2006;37:91-102.

13. Ubassy G. Shape and color: the key to successful ceramic restorations. Berlin: Quintessenz Verlag; 1993.

14. Dietschi D. Free-hand composite resin restorations: a key to anterior aesthetics. Pract Periodont Aesthet Dent. 1995;7(7):15-25.

15. Dietschi D. Free-hand bonding in esthetic treatment of anterior teeth: creating the illusion J Esthet Dent. 1997;9:156-64.

16. Dietschi D. Layering concepts in anterior composite restorations. J Adhesive Dent. 2001;3(1):71-80.

17. Litonjua LA, Andreana S, Bush PJ, Cohen RE. Tooth wear: attrition, erosion, and abrasion. Quintessence Int. 2003;34:435-46.

18. Lavigne GJ, Khoury S, Abe S, Yamaguchi T, Raphael K. Bruxism physiology and pathology: an overview for clinicians. J Oral Rehabil. 2008;35:476-94.

19. Lavigne GJ, Kato T, Kolta A, Sessle BJ. Neurobiological mechanisms involved in sleep bruxism. Crit Rev Oral Biol Med. 2003;14(1):30-46.

20. Lussi A, Hellwig E, Zero D, Jaeggi T. Erosive tooth wear: diagnosis, risk factors and prevention. Am J Dent. 2006;19:319-25.

21. Zero DT, Lussi A. Erosion—chemical and biological factors of importance to the dental practitioner. Int Dent J. 2005;55(4 Suppl 1):285-90.

22. Lussi A, Jaeggi T, Zero D. The role of diet in the aetiology of dental erosion. Caries Res. 2004;38 Suppl 1:34-44.

23. Mahoney EK, Kilpatrick NM. Dental erosion: part 1. Aetiology and prevalence of dental erosion. NZ Dent J. 2003;99:33-41.

24. Ibsen RL, Ouellet DF. Restoring the worn dentition. J Esthet Dent. 1992;4:96-101.

25. Christensen G. A new technique for restoration of worn anterior teeth. J Am Dent Assoc. 1995;126:1543-7.

26. Marais JT. Restoring palatal tooth loss with composite resin, aided by increased vertical height. J South African Dent Assoc. 1998;53:111-9.

27. Goodacre CJ, Bernal G, Rungcharassaeng K, Kan JY. Clinical complications in fixed prosthodontics. J Prosthet Dent. 2003 Jul;90(1):31-41.

28. Scurria MS, Bader JD, Shugars DA. Meta-analysis of fixed partial denture survival: prostheses and abutments. J Prosthet Dent. 1998 Apr;79(4):459-64.

29. Satterthwaite JD. Indirect restorations on teeth with reduced crown height. Dent Update. 2006;33:210-2, 215-6.

30. Cutbirth ST. Increasing vertical dimension: considerations and steps in reconstruction of the severely worn dentition. Pract Proced Aesthet Dent. 2008;20:619-26.

31. Robinson S, Nixon PJ, Gahan MJ, Chan MF. Techniques for restoring worn anterior teeth with direct composite resin. Dent Update. 2008;35:551-2, 555-8.

32. Vailati F, Belser UC. Full-mouth adhesive rehabilitation of a severely eroded dentition: the three-step technique. part 1. Eur J Esthet Dent. 2008;3:30-44.

33. Vailati F, Belser UC. Full-mouth adhesive rehabilitation of a severely eroded dentition: the three-step technique. part 2. Eur J Esthet Dent. 2008;3:128-46.

34. Vailati F, Belser UC. Full-mouth adhesive rehabilitation of a severely eroded dentition: the three-step technique. part 3. Eur J Esthet Dent. 2008;3:236-57.

35. Hemmings KW, Darbar UR, Vaughan S. Tooth wear treated with direct composite restorations at an increased vertical dimension: results at 30 months. J Prosthet Dent. 2000;83:287-93.

36. Bartlett D, Sundaram G. An up to 3-year randomized clinical study comparing indirect and direct resin composites used to restore worn posterior teeth. Int J Prosthodont. 2006;19:613-7.

37. Gow AM, Hemmings KW. The treatment of localised anterior tooth wear with indirect Artglass restorations at an increased occlusal vertical dimension. Results after two years. Eur J Prosth Restor Dent. 2002;10:101-5.

38. Luther F. TMD and occlusion part II. damned if we don't? functional occlusal problems: TMD epidemiology in a wider context. Br Dent J. 2007;202:38-9.

39. Michael JA, Townsend GC, Greenwood LF, Kaidonis JA. Abfraction: separating fact from fiction. Aust Dent J. 2009;54(1):2-8.

40. Van 't Spijker A, Kreulen CM, Creugers NH. Attrition, occlusion, (dys)function, and intervention: a systematic review. Clin Oral Implants Res. 2007;18:117-26.

41. Redman CD, Hemmings KW, Good JA. The survival and clinical performance of resin-based composite restorations used to treat localised anterior tooth wear. Brit Dent J. 2003;194:566-72.

42. Poyser NJ, Briggs PF, Chana HS, Kelleher MG, Porter RW, Patel MM. The evaluation of direct composite restorations for the worn mandibular anterior dentition––clinical performance and patient satisfaction. J Oral Rehabil. 2007;34:361-76.

43. Smales RJ, Berekally TL. Long-term survival of direct and indirect restorations placed for the treatment of advanced tooth wear. Eur J Prosthodont Restor Dent. 2007;15(1):2-6.

44. Pincus CL. Building mouth personality. Paper presented at California State Dental Association, San Jose, California, 1937.

45. Faunce FR, Myers DR. Laminate veneer restoration of permanent incisors. J Am Dent Assoc. 1976;93:790-2.

46. Helpin LM, Fleming JE. Laboratory technique for the laminate veneer restoration. Pediatr Dent. 1982;4:48-50.

47. Haas BR. Mastique veneers: a cosmetic and financial alternative in post-periodontal care. J NJ Dent Assoc. 1982;53:25-7.

48. Jensen OE, Soltys JL. Six months clinical evaluation of prefabricated veneer restorations after partial enamel removal. J Oral Rehabil. 1986;13:49-55.

49. Rochette AL. A ceramic restoration bonded by etched enamel and resin for fractured incisors. J Prosthet Dent. 1975;33:287-93.

50. Calamia JR. Etched porcelain facial veneers: a new treatment modality based on scientific and clinical evidence. NY J Dent. 1983;53:255-9. **jCD**

Dr. Dietschi is a senior lecturer, Department of Cariology & Endodontics, School of Dentistry, University of Geneva, Switzerland. He also is an adjunct professor, Department of Comprehensive Dentistry, Case Western Reserve University. Dr. Dietschi is in private practice at the Geneva Smile Center, in Geneva, Switzerland.

Disclosure: The author has financial interest in and/or material support from Coltène/Whaledent.