NATURAL LAYERING CONCEPT

— a simple, reliable and effective protocol to achieve high esthetics with freehand bonding techniques

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Introduction

Natural, restored or orthodontically enhanced smiles may present esthetic deficiencies that require treatment.[1, 2, 6] However, the search for a perfect smile should note drive the clinician to use primarily invasive solutions such as veneers and crowns to resolve all esthetic anomalies, since such procedures will have a negative impact on the long-term tooth bio-mechanical behavior and treatment cost. The freehand option, which is more conservative and cost-effective, should then always be considered as our first choice, if feasible.[3, 4, 5] In this context, composite resins represent the material of choice for young patients and less privileged people, or in any case those who require a strictly conservative approach. The natural layering concept has enabled this objective to be achieved in a predictable way, by incorporating newly acquired knowledge about natural tissue optical properties into contemporary composite systems. This advance can be regarded as a milestone in operative dentistry as it will give direct composite application a tremendous input, helping a larger number of our patients to receive both conservative and highly aesthetic restorations; this concept was described as the "bio-esthetic" approach.

The aim of this article is to illustrate the bio-esthetic philosophy and Natural Layering Concept (NLC), applied to solve two advanced esthetic cases.

Pre & post-operative views of a smile restored with direct composites veneers, demonstrating the potential of a free-hand approach and new composite technology.

Fig. 1a
Intra-operative view of the case appearing on the cover page; direct composite veneers were made of 2 only layers (dentin & enamel), with apposition of some blue & white effect shades (inspiro, Edelweiss DR) following the Natural Layering Concept (NLC).

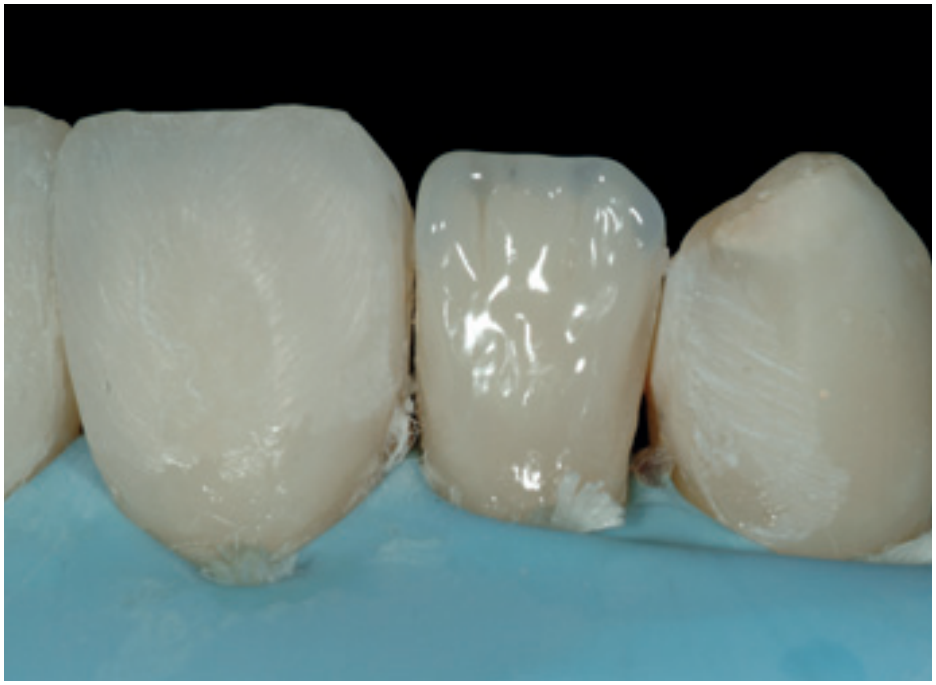

Fig. 1a

The Natural Layering Concept (NLC)
*The dentin L*a*b* color measurements of teeth from the "A", "B" and "C" VITA shade groups, have suggested that an ideal dentin replacement material should exhibit the following characteristics:*[7] [8]

Single hue.
Single opacity.
Large chroma scale (beyond the four chroma levels of the VITA system).

Actually, the variations of a* and b* values between various VITA shades seem not to justify the use of distinct dentin colours, at least for a direct composite restorative system. Likewise, the variations of the contrast ratio (opacity-translucency) within a single shade group, do not support the use of different dentin opacities (i.e.: translucent, regular or opaque dentins). However, chroma (related to a* and b* values) proved to increase from light to dark shades (A1 to A4 or B1 to B3) and then support the concept of a large chroma scale covering all variations of natural dentitions, plus some specific conditions like sclerotic dentin (as found underneath decays, fillings or cervical lesions).

As regard to enamel, differences in tissue lightness and translucency proved to vary largely among patients and with tooth age, and therefore confirmed the clinical concept of three specific enamel types:[9]

Young enamel: white tint, natural opalescence, less translucency.
Adult enamel: neutral tint, natural opalescence and intermediary translucency.
Elderly enamel: yellow tint, natural opalescence and higher translucency.

This interpretation of human dentin and enamel colorimetric data led to this clinical approach named the "Natural Layering Concept" (NLC), which embraces more accurately the optical and anatomical characteristics of natural teeth.[3] [4] [5] [7] It actually defines the features of an optimal restorative material aimed to replace dentin and enamel, respectively. Dentins shades should be available in one single hue (close to VITA "A" shade group) with a sufficient range of chroma (covering at least the existing VITA shade range), and presenting opacity similar to natural dentin. Enamel shades should present different tints and opacity levels, tentatively replicating the major variations found in nature. The latest development of this system is the inspiro (Edelweiss DR); previous generations include for instance Miris® & Miris® 2 (Coltène/Whaledent), Ceram.X® duo (DENTSPLY), ASTERIA (Tokuyama), Aura (SDI) or ENAMEL HFO/HRI (Micerium).

Case 1
An adult female patient shows esthetically defective composite veneers; she hopes for a significant improvement although she has strict financial limitations, driving the treatment plan toward the replacement of existing restorations by a similar freehand, but improved technique (cover page figures). A new generation NLC composite system (inspiro, Edelweiss DR) was selected, due to its improved optical properties and excellent surface characteristics (easy polishability and good gloss retention), resulting from a new filler technology (homogenous nano-hybrid composite). This material has no clustered nano-particles or pre-polymerized fillers, which proved to impact negatively the esthetic performance of conventional inhomogeneous nano-hybrid composites.
A rubber dam was applied to optimize adhesive and restorative procedures; indeed, such extensive treatment using a direct technique would be less predictable without this isolation procedure, which eliminates moisture from breath completely, crevicular fluid extravasation and possibly slight gingival bleeding. Restorations were made using a bi-laminar restorative approach based on one dentin shade (Body i2 for the central and lateral incisors and Body i3 for the canines; selected masses are close to A2 and A3 VITA shades). In addition, a small amount of blue effect shade (Azur, inspiro) was placed over the dentin mamelons to emulate localized opalescent halo **(Fig. 1a)**.
Finishing and polishing was performed under rubber dam which protect soft tissues for inadvertent aggression. The primary anatomy was corrected with finishing discs of decreasing coarseness (Optidisc, Kerr). When the appropriate proximal and tooth axial profiles were considered optimal, the incisal length and profile were finished using the same instruments as well as fine finishing diamonds burs. Only three instruments were used to complete the secondary anatomy (micro-texture), starting with a flame, fine diamond (40 µm), followed by a pre-polisher rubber point (Identoflex® minipoint, Kerr) and a diamond impregnated rubber cup (Hi-Luster, Kerr). This simplified instrument sequence led to the good surface anatomy and quality shown on **Figures 1b–g**.

Case 2
A young male patient presents various esthetic deficiencies. An orthodontic correction previously helped to manage space excess, following congenital lateral incisor aplasia **(Figs. 2a–d)**. The dento-facial analysis **(Fig. 3)** reveals a serious asymmetry between the face and smile midline,

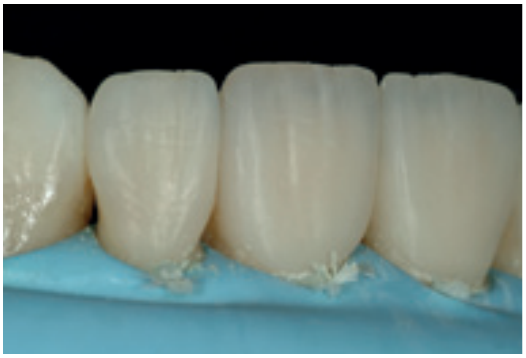

Fig. 1b

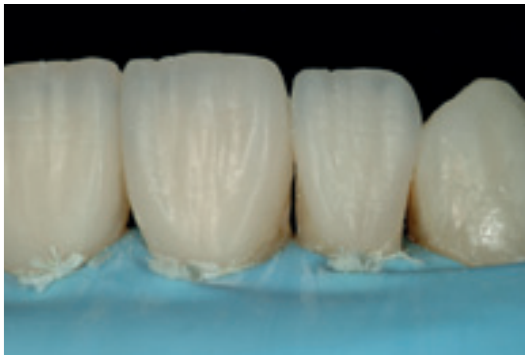

Fig. 1c

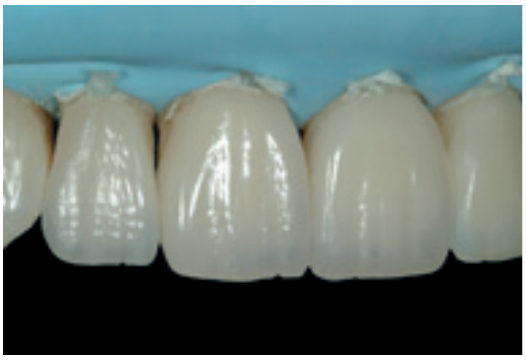

Fig. 1d

Fig. 1e

Fig. 1f

Fig. 1g

Figs. 1b–g
Intra-operative view of the case appearing on the cover page; direct composite veneers were made of 2 only layers (dentin & enamel), with apposition of some blue & white effect shades (inspiro, Edelweiss DR) following the Natural Layering Concept (NLC).

Figs. 1b–c
Post-finishing using a fine diamond bur (flame shape) and silicone pre-polishers.

Figs. 1c–g
Polished restorations before rubber dam removal and after functional adjustments.

which results from an underlying orthognathic deviation (dental arches and smile are not aligned with the face) which the patient refused to treat. A computer assisted smile analysis was performed with extra- and intra-oral photographs, manipulated and altered with PowerPoint Software (Microsoft).[10] The remaining esthetic deficiencies following orthodontic treatment could be better identified and the resulting treatment planning was explained to the patient **(Figs. 3c and d)**.

The following esthetic abnormalities were to be corrected:

Tooth axis (upper laterals and canines).
Tooth forms (upper centrals, canines and lower incisors).
Tooth color (upper canines).
Gingival profile (upper premolars).

It was agreed with the patient to conduct the gingival profile correction for upper first premolars at a later stage.

With the first case, all adhesive and restorative procedures were performed under rubber dam to optimize the quality and longevity of the restorations. The same composite system was used (inspiro), based on a bi-laminar approach (body and skin shades = dentin and enamel shades) to emulate the natural tooth anatomy and the optical characteristics. The body shade (inspiro i2) was used only for the canines (transformed into laterals incisors), to block the light and translucency within the large preexisting incisal embrasures. For central incisors (axis and mesio-distal width corrections), only an enamel shade was used (inspiro skin white & ivory) as the total layer thickness did not exceed 1 to 1.25 mm, which is the natural enamel thickness. Pre-contoured matrixes helped to obtain natural proximal contours and emergence profile (Lucifix 775 & 776, Kerr). Finishing and polishing procedures were identical to those used for the case.[1] Postoperative views **(Figs. 4e and 5)** demonstrate improved intra-oral and extra-oral smile integration, although the dento-facial asymmetry could not be corrected through restorative procedures. This treatment approach is considered optimal for young patients showing noticeable esthetic deficiencies, of an otherwise perfectly healthy dentition.

Discussion – conclusion

The natural layering concept has enabled patient's aesthetic expectations to be fulfilled in a predictable way, by incorporating new knowledge about natural tissue optical properties into a new restorative approach for direct, freehand restorations. It allowed a significant simplification of clinical procedures, making this technique accessible to general practitioners as well. This advance can be regarded as a milestone in operative dentistry, giving a new input to freehand bonding and helping more patients to receive conservative and highly aesthetic restorations.

Fig. 2a

Fig. 2b

Fig. 2c

Figs. 2a–d
Preoperative extra & intra-oral status. The patient has congenitally missing upper laterals and one lower incisor. Following conventional orthodontic treatment, many esthetic problems remain, such as tooth axis, forms, proportions and overall smile configuration.

Fig. 2d

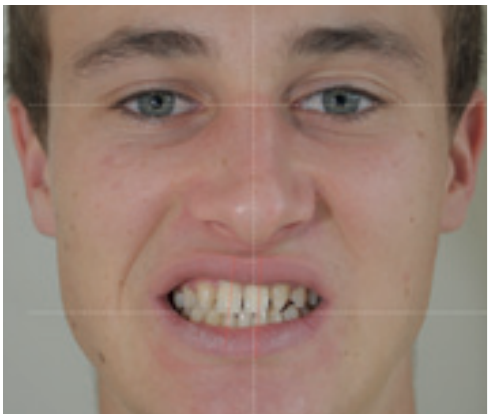

Fig. 3a

Fig. 3b

Figs. 3a–b
Computer assisted smile analysis & design: The most important lines are being drawn (facial midline, bi-pupillary plane, occlusal plane, tooth axis, etc...) and help to establish the list of major/minor esthetic deficiencies.

Figs. 3c–d
hen, new tooth forms and smile configuration can be drawn and partially opacified, to show the patient the expected changes (the red lines show the potential gingival profile correction of the upper first premolars).

Fig. 3c

Fig. 3d

Figs. 4a–b
Chair-side bleaching using 35% hydrogen peroxide was performed, to reduce the higher chroma of canines, before continuing with bonding procedures (a = intra-operative and b = post-bleaching view).

Figs. 4c–d
Intra-oral views during direct restorative procedures; the rubber-dam secured the quality of adhesion as well as a better access to all surfaces to be additively restored. The rubber dam also protects soft tissues during finishing and polishing procedures. The Natural Layering Concept (NLC) was used to obtain a more predictable and optimal treatment outcome, using the new inspiro system (edelweiss DR).

Fig. 4e
Post-treatment view, following the corrections of tooth axis, dimensions and proportions and tooth form of the upper six front teeth (previously upper first premolars, canines and central incisors).

Figs. 5a–d
Postoperative extra & intra-oral status. A no prep restorative approach was used which fulfilled the esthetic needs of the patient, using a NLC composite system (inspiro, Edelweiss DR). The treatment outcome is made more predictable, due to the simplicity and reliability of the shading system, including the color taking.

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

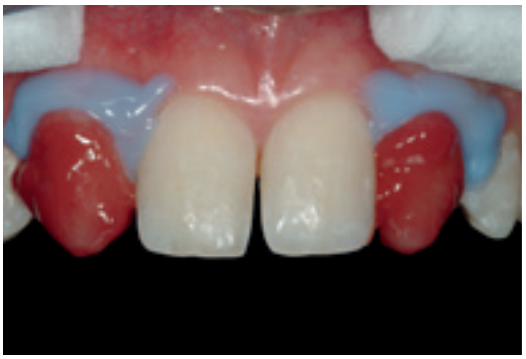
Fig. 4a


Fig. 4b

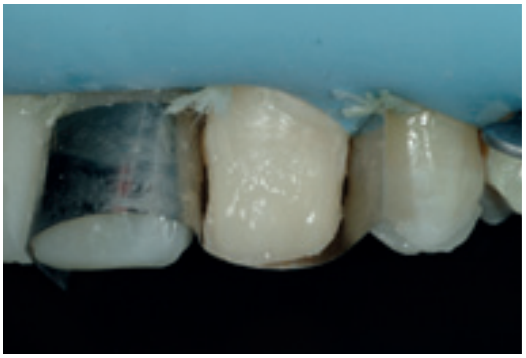
Fig. 4c


Fig. 4d


Fig. 4e


Fig. 5a


Fig. 5b


Fig. 5c


Fig. 5d