Learning and applying the Natural Layering Concept

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Composite resins nowadays occupy a paramount position among restorative materials because they offer excellent aesthetic potential and acceptable longevity, with a much lower cost than equivalent ceramic restorations for the treatment of both anterior and posterior teeth. In addition, composite restorations allow for minimally invasive preparations or no preparation at all when replacing decayed or missing tissues. This approach is part of a new concept termed bio-aesthetics that gives priority to non-restorative or additive procedures, such as bleaching, micro-abrasion, enamel re-contouring, direct composite resins, bonded bridges, and implants, in the case of missing dental units or cases that are more complex. These many procedures definitely merit further attention because they offer tremendous improvements in practicability, efficiency and predictability. All together, bio-aesthetics undoubtedly moves aesthetic and restorative dentistry to a new level; one that can be described as comprehensive and conservative smile design.

For quite some time, the creation of perfect direct restorations has been an elusive goal because of the imperfect optical properties of composite resins and perfectible clinical procedures. The attempt to mimic the shades and layering techniques developed for ceramic restorations led to complicated application methods, controllable only by highly skilled practitioners. For years, this has limited the number of patients who could benefit from the tremendous advantage of free-hand bonding. 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) have been essential in developing better direct tooth-coloured materials.
The Natural Layering Concept (NLC) is a simple and effective approach to the creation of highly aesthetic direct restorations. The concept is increasingly referred to in the field of composite restorations; thus, the aim of this article is to familiarise the practitioner with the features and clinical aspects of this new technique.

A new array of indications for free-hand bonding

Besides classical indications, such as the filling of Class III, IV and V cavities, many other aesthetic or functional problems can be addressed by simple direct composite restorations. The indications are as follows:

1) Congenital aesthetic deficiencies
   Owing to the early preoccupation of patients with these aesthetic anomalies, a conservative aesthetic correction of these conditions is increasingly mandated (Figs. 1a–f):
   - displasia/discolorations;
   - hypoplasia;
   - unusual tooth forms or dimensions; and
   - diastemas.

2) Post-orthodontic conditions
   Lateral incisor aplasia or incorrigible canine impactions are frequent findings, approached often with an orthodontic solution. Unfortunately, different anatomical, functional and aesthetic anomalies may result from such an orthodontic approach. Patients’ increasing concern for aesthetics obliges the dental team to correct these deficiencies (Figs. 2a–h):
   - unusual crown dimensions (larger or smaller);
   - unusual root diameter (larger or smaller);
   - unusual shape of the crown;
   - difference in colour (mainly for cuspids); and
   - difference in gingival contour or level.

3) Acquired and other aesthetic deficiencies
   Many other aesthetic deficiencies in fairly intact dentitions also require conservative correction (Figs. 3a–e):
Figs. 2a–c. Smile of a 30-year-old patient showing aged and unaesthetic composite reconstructions of canines, following lateral incisor aplasia.

Fig. 2d. A rubber dam is in place from premolar to premolar to allow for a full smile view and comprehensive correction of the six front teeth.

Figs. 2e–h. The post-op views show the final conservative smile rehabilitation, using direct bonding to re-establish better tooth proportions and forms (enlargement of central incisors, reshaping of lateral incisors and premolars).

Cosmetic dentistry 2009

Discolourations (i.e. traumatised non-vital tooth);

diastemas;

abrasion, abrasion and erosion lesions;

tooth fractures;

caries; and

functional deficiencies.

All aforementioned conditions are potential indications for conservative additive treatments, according to pre-existing tissue loss and functional status.

A new shading concept

The use of the natural tooth as a model was a logical development of direct restorative materials that led to the simplified shading and layering concept, the NLC. It is based on the identification of true dentine and enamel optical characteristics using tristimulus L*a*b* colour and contrast ratio measurements.1,4

Dentine replacement

The aforementioned measurements led to the following recommendations regarding the optical characteristics of an ideal material aimed at replacing dentine:

single hue;

single opacity; and

large chroma scale (beyond the four chroma levels of the VITA system)
Actually, 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. Likewise, the variations of the contrast ratio (opacity–translucency) within a single shade group did not support the use of different dentine opacities (i.e. translucent, regular or opaque dentine). However, the concept of a large chroma scale covering all variations of natural dentitions plus some specific conditions like sclerotic dentine (as found underneath decays, fillings or cervical lesions) proved justified.

Enamel replacement
Concerning enamel, differences in tissue lightness and translucency proved generally to vary with tooth age. This confirmed the clinical concept of three specific enamel types:16

- Young enamel: White tint, high opalescence, lower translucency;
- Adult enamel: Neutral tint, lower opalescence, intermediate translucency; and
- Old enamel: Yellow tint, higher translucency.

These findings have logically fashioned the concept of an optimal restorative material. Dentine shades should be available in one single hue (VITA ‘A’ or Universal dentine shade) with a sufficient range of chroma (covering at least the existing VITA shade range) and presenting opacity similar to that of natural dentine. Enamel shades should present

Fig. 3a. Young adult presenting hypoplasia of numerous front teeth. Some lesions were previously restored with an incorrect direct composite technique.

Figs. 3b & c. Teeth were bleached before initiation of a new restorative phase. The previous composite material was first removed to expose underlying sound tissue.

Figs. 3d & e. Better tooth shape and colour integration could be achieved through a simplified and improved direct restorative technique (NLC) and Miris 2.
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Various tints and opacity levels, tentatively replicating all variations found in nature. Well-known brand names include Miris and Miris 2 (Coltène Whaledent), Ceram-X duo (Dentsply) and Enamel HFO (Micerium).

The influence of the Natural Layering Concept on shade recording

The quality of the final restoration depends on correct shade evaluation. According to the NLC, there are only two basic steps involved: The selection of the dentine chroma in the cervical area, where enamel is the thinnest, using samples of the composite material; and the selection of the enamel tint, often performed by simple visual observation.

With the special Miris and Miris 2 shading systems, each combination of dentine and enamel shades can be evaluated and compared to reference teeth, so that the risk of incorrect shade selection and aesthetic outcome is minimised. In specific and less frequent cases, a third step might be involved in the form of a visual or photographic mapping of the tooth special optical effects (such as white hypocalcification, high opalescence areas or areas with a higher chroma). In this situation, the application of effect materials, such as white, blue or orange-gold (i.e. Miris Effects, Coltène Whaledent), may be recommended.

The effect of tooth ageing on dentine and enamel optical properties

Special attention has to be paid to the morphological changes that affect the incisal edge anatomy. Young tooth configuration: The dentine core that has a low chroma is fully covered with a white, opalescent enamel. Adult tooth configuration: The dentine core with medium chroma is usually covered with a more neutral, opalescent enamel. Dentine extends close to, or is even exposed at, the incisal edge. Old tooth configuration: The dentine core with higher chroma is covered with a thinner, more yellow and translucent opalescent enamel. Dentine extends to the incisal edge.

Clinical application of the Natural Layering Concept

Composites can be applied by following different incremental techniques for aesthetic or practical reasons and better management of polymerisation stresses. The classical approach is the centrifugal technique, indicated for Class III, small Class IV, and limited form corrections (Figs. 4a—c). It implies the placement in depth of one or two dentine layers (in Class III cavities, 01 with oblique position), followed by the enamel, covering the entire surface.

Another commonly used incremental approach is the bucco-lingual technique (Figs. 4d—g). It makes use of a silicone key made from either a free-hand mock-up (simple cases) or wax-up (advanced cases). The first layer of enamel is placed directly on the silicone key, so that it provides the lingual profile, width and position of the incisal edge of the future restoration in one step. Thereafter, dentine and effect materials (when needed) can be applied in a precise 3-D configuration. This provides the conditions for an optimal aesthetic result, as well as translucency, opalescence and halo effects.

A new learning experience at the Geneva Smile Center

The Geneva Smile Center (GSC) strives for excellence in teaching comprehensive and conservative smile design and tooth-coloured posterior

Fig. 4a

Fig. 4b

Fig. 4c

Fig. 4d

Fig. 4e

Fig. 4f

Fig. 4g
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restorations (Figs. 6a–c). The three programmes offered thus far cover adhesive, aesthetic anterior and posterior direct and indirect restorations. The anterior programme consists of two courses run over three days (advanced and master levels), while the comprehensive posterior programme is run over three days.

All courses include well-balanced theoretical and hands-on components, which provide participants with the necessary scientific evidence to support clinical decisions and procedures and with ample time to practise the different procedures, leading to expertise in a developing field of dentistry. Dentists are spoilt today with a vast choice of procedures and products; therefore, it is essential to analyse the results of clinical studies and identify those options that guarantee long-term success. Translating complex and abundant in vitro and in vivo research data into clinical essentials has become one of the major assets of the education programme amongst the GSC programmes, next to the unsurpassed quality of practical teaching.

Another important aspect of these programmes is the focus on precision. The use of Zeiss microscopes, installed at each working station, helps participants to work with better vision and optimal precision, which is the key to success in aesthetic restorations and easier application of all kinds of adhesive procedures. Magnification lenses are also available for trial. These tools are of great help in the context of such courses, even though microscopes are not mandatory for routine treatments in restorative dentistry. There is also a great emphasis placed on individualised teaching, and the programmes at the GSC provide plenty of time to interact directly with course instructors. This is the reason that courses are organised for small groups with a maximum of 20 participants.

It is likely that the present economical situation or ‘crisis’ will also affect our profession. If it could ever have a ‘positive’ effect for us, this might be in the form of patients becoming more discriminative in their search for aesthetic treatments. We can
therefore expect that patients and dentists will better understand the tremendous advantage of non-invasive techniques, which can not only fulfil many of our aesthetic needs, but will also contribute to better preserving patient dental capital.

The vision at the GSC is to share knowledge and 25 years of clinical expertise with colleagues from around the world and to improve and facilitate their existing operation protocols, as well as instrument and product selection, and ultimately to help them achieve the highest level of aesthetics and precision in restorative dentistry.

Conclusion

Traditional restorative objectives have not changed over time; rather, the implementation of restoratives has been based on the aesthetic demands of an increasing number of patients. Composite resins, which require a strictly conservative approach, have thus become the materials of choice for young patients and less privileged people. The contemporary practitioner is ultimately challenged to replace the missing tissues or eventually modify their configuration, by applying an artificial material to the patient’s teeth, which has to simulate the appearance of natural tissues. The NLC 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 contribute tremendously to direct composite application, helping a larger number of our patients to receive aesthetic restorations that are more conservative.

Further information, including studies for Miris 2, is available at www.coltenewhaledent.com. For online education possibilities please visit www.globalinstituteonline.com.

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Dr Didier Dietschi lecture events 2009–2010

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