The Parallel Stratification Masking Technique: an Analytical Approach to Predictably Mask Discolored Dental Substrate

Michel Magne, MDT, BS
President, 901 Dental Laboratory, Marina del Rey, CA, USA

Inge Magne, CDT, BS
Vice-President, 901 Dental Laboratory, Marina del Rey, CA, USA

Panaghiotis Bazos, DDS
Emulation, 33 Vasilissis Sophias Ave. 10675 Athens, Greece

Maria Paula Gandolfi Paranhos, DDS, MS, PhD
Research Associate, 901 Dental Laboratory, Marina del Rey, CA, USA
and Clinical Instructor, Herman Ostrow School of Dentistry at USC,
Los Angeles, CA, USA

Correspondence to: Michel Magne
4052 Del Rey Avenue, #108, Marina del Rey, CA 90292, USA
phone/fax: +1 (310) 821 9461, e-mail: info@901-LA.com

Abstract

Discolored dental substrates continue to challenge the restorative team when ultraconservative treatment modalities are chosen. An innovative laboratory concept – the parallel stratification masking technique – has been developed in order to achieve maximum preservation of dental hard tissues and predictably accomplish a desirable esthetic outcome. The major advantages of this technique are that the ceramist is able to: *a)* identify and map the discolored dental substrate, *b)* predictably mask the discolored dental substrate, and *c)* assess the appropriate masking efficacy of the fabricated restoration prior to laboratory delivery to the dentist in cases of bonded porcelain restorations.

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Fig 1a Alveolar model.

Introduction

As a consequence of improved adhesive techniques, the indications for traditional full coverage restorations have decreased, giving way to more conservative approaches.[1] Although adhesive treatments simplify both clinical and laboratory procedures, restoring those cases that have severely discolored dental substrates remains a challenging and arduous task for the entire dental team.[2-4]

Traditionally, layered veneers or full ceramic restorations have exhibited their limitations when it comes to neutralizing severely discolored tooth structure. These limitations are mainly due to the inability of the ceramist to properly regulate the amount of restoration opacification required, so as to effectively mask the discolored dental substrate and render the optical result as clinically acceptable.

Hyper-opacification leads to a mundane monochromatic high value restoration, whereas a hypo-opacified restoration fails to efficiently mask the optical nuances of the discolored dental substrate.[5]

In an attempt to mitigate the discolored dental substrate, some studies have proposed the additional removal of tooth structure in order to create space for direct or indirect placement of sub-opacifying resin material.[6-9] Bleaching the tooth after veneer preparation has also been proposed.[10]

In the parallel stratification masking technique, the unnecessary additional removal of tooth structure can be avoided with the controlled application of fluorescent porcelains (In-Nova Creation, Jensen Dental, North Haven, CT, USA). These special porcelains can be initially applied and tested as thin washes on the dentin porcelain stump shade guide, and subsequently on the refractory die prior to the stratification of the restoration in the laboratory. The proper use of masking porcelains leads to more conservative, natural appearing restorations.

This innovative masking approach may be efficiently integrated with the alveolar model,[11] a modular system that consists of a dento-gingival alveolar base (Fig 1a) with a number of function-specific removable and interchangeable dies (Fig 1b), which facilitate the fabrication of bonded porcelain restorations.

The purpose of the present article is, therefore, to describe the parallel stratification masking technique when restoring discolored anterior teeth with bonded porcelain restorations. An illustrated laboratory protocol is presented.

Fig 1b The function-specific removable and interchangeable dies.[11]

Parallel stratification masking technique sequence

Step one

Photographic documentation of the tooth subsurface characteristics (after tooth preparation and prior to impression taking) is carried out, together with the base dentin shade selection. This step is performed by the dental clinician to obtain and relay a visual identification map to the laboratory technician (Fig 2).

Fig 2 The subsurface characteristics of the teeth after veneer preparation, together with the base dentin shade selection.

Step two

The laboratory technician generates the alveolar model[11] (Fig 1) and fabricates a customized chromatic dentin tab out of porcelain (Fig 3). This dentin

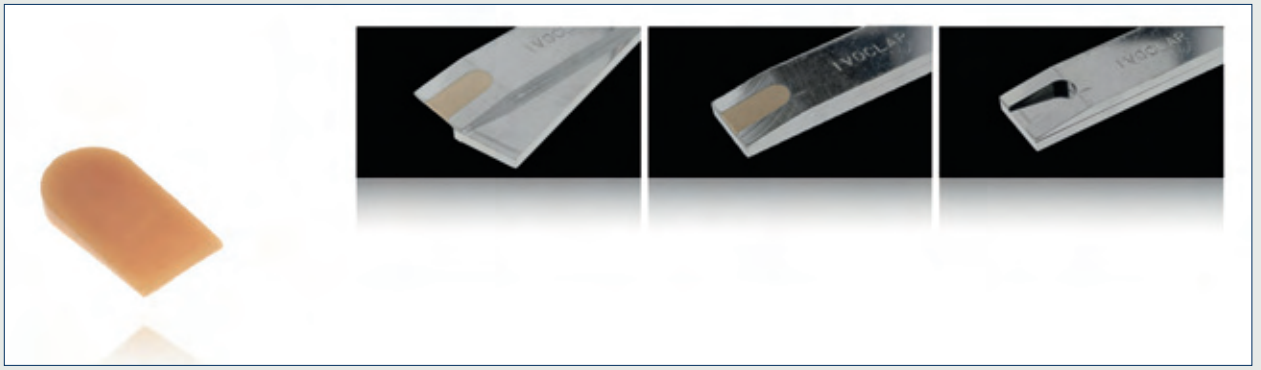

Fig 3 Customized chromatic dentin tab fabricated out of porcelain.

Fig 4 Sequential masking layers applied in the form of thin washes, where each layer is individually fired until the desired opacification of the test substrate is achieved.

tab should correspond to the most discolored tooth structure; this will be used as the test substrate to evaluate the masking efficacy of the fluorescent porcelains.

Step three

Sequential masking layers are applied in the form of a thin wash, and each layer is individually fired until the desired opacification of the test substrate is achieved (Fig 4). Having thus qualified and quantified the wash material, the technician may initiate a parallel stratification strategy to achieve the final restorations using the refractory die technique.

Step four

The universal or selective subsurface masking approach can be performed based on the visual identification of the masking map. Standardized stratification of porcelain is then completed and surface texture is finalized.

Universal masking (Case 1: Figs 5–8)
The first masking layer is applied to block the discoloration underneath and to create an equal base (Fig 6). This technique is usually applied when one tooth is nonvital and the stump shade may change with time. Therefore, the stump color needs to be entirely blocked out.

Fig 5 Preoperative view of the patient's teeth. A 35-year-old female with a discolored endodontically treated central incisor.

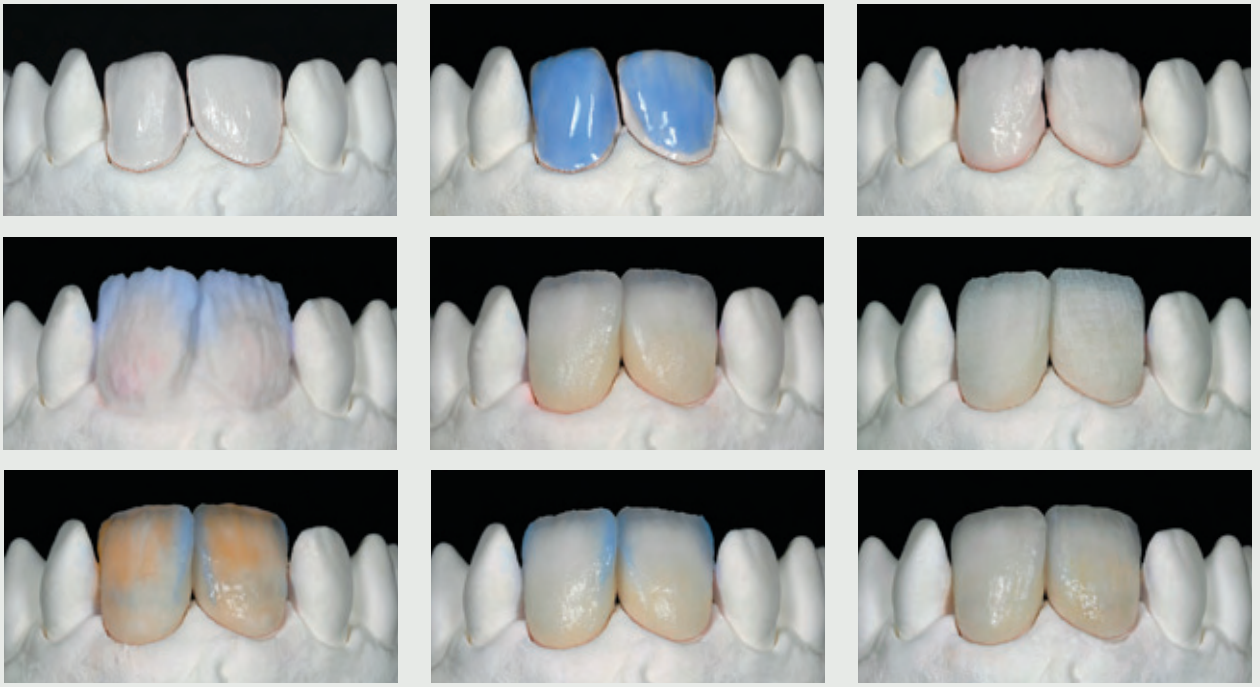

Fig 6 Sequence of the porcelain application. The first masking layer blocks the discoloration underneath and creates an equal base. This is followed by the normal stratification layering technique.

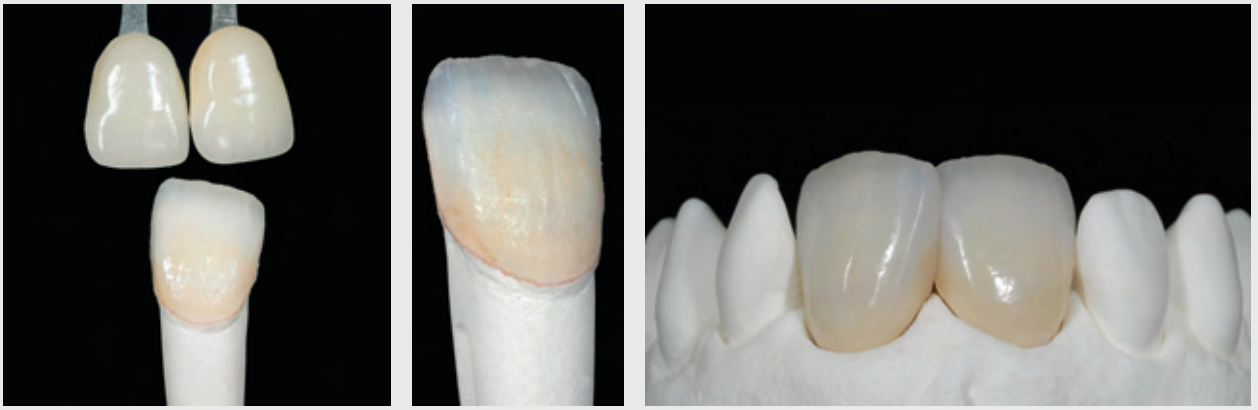

Fig 7 Shade control after firing the first layer of dentin is carried out in an effort to maintain the selected shade.

Fig 8a-c The final porcelain veneers and their integration with the patient's lips and face.

Fig 9 Intraoral view of preparation for veneers. Classic tetracycline stained case with prominent horizontal banding, which is highlighted after the preparation of the teeth.

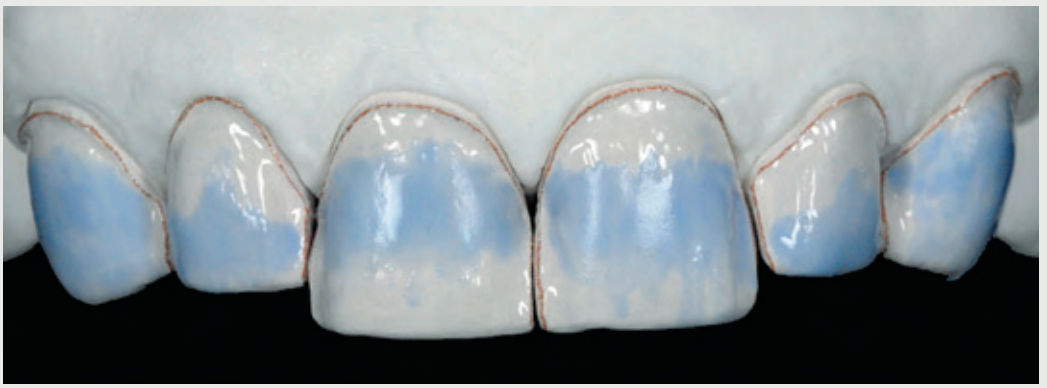

Fig 10 **(a)** Masking map of the strongly discolored areas. **(b)** The same masking map transferred to the refractory model with masking porcelain layers.

Fig 11 **(a and b)** Selective masking of the specific sites of prominent discoloration is carried out by placing the first fluorescent porcelain masking layer. This first layer helps with achieving primary color neutralization. **(c)** Subsequent fluorescent washes are utilized in order to create a masking gradient that equalizes the restorative canvas. This layer acts as a filter to soften the transition between the masking layer and the natural tooth structure.

Fig 12 **(a and b)** The final porcelain veneers and their integration with the patient's lips and face.

Selective masking (Case 2: Figs 9–12)
The first masking layer is applied to strongly mask the discolored areas (Figs 10 and 11a and b). The second masking layer is applied a little wider than the first one, as a filter to soften the transition between masking layer and natural tooth structure (Fig 11c). This technique is usually applied in classic tetracycline stained cases with prominent horizontal banding, highlighted after the preparation of the teeth (Fig 9). In certain situations, opaque modifier powder is added to the initial porcelain mix to cover strong existing discoloration (ie, metal or solid black/dark color). In such cases, the use of a high concentration of internal colorants could affect the strength of the porcelain and lead to the occurrence of cracks.

Step five

An optical verification die (known as the alveolar delta die[11]) is fabricated out of poly(methyl methacrylate) (PMMA, New Outline, Anaxdent, Stuttgart, Germany) to assess the appropriate masking efficacy of the divested final restoration. This is carried out prior to laboratory delivery to the dentist (Fig 13).

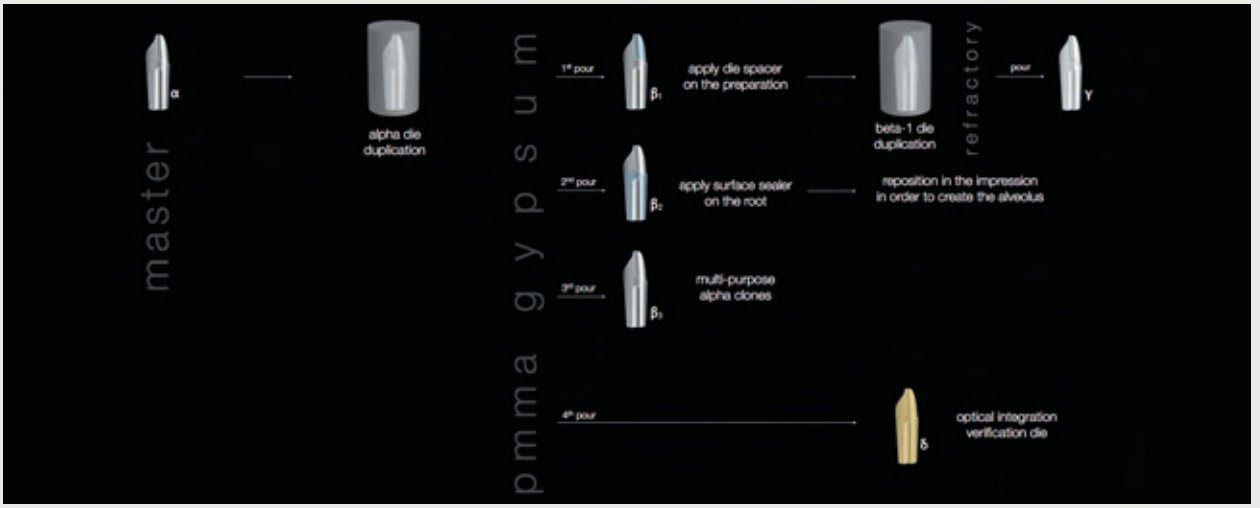

Fig 13 An optical verification die (known as the alveolar delta die[11]) is fabricated out of poly(methyl methacrylate) (PMMA) to assess the appropriate masking efficacy of the final restoration prior to laboratory delivery to the dentist.

Conclusions

Optical integration of bonded porcelain restorations on highly discolored dental substrates can be effectively and predictably achieved when a systematic method is used. This is readily accomplished with the utilization of the alveolar model in conjunction with the novel parallel stratification masking technique.

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