LAB talk

Laboratory perspectives from the inside out.

Creating Physiologic Contours Using a Modified Geller Cast Technique

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For a restoration to be successful clinically it needs to satisfy several criteria:

- mechanical/structural requirements (ie, durability) of both the tooth and the restoration;
- esthetic requirements of position, form, and color; and
- biologic requirements of pulpal health, prevention of caries, and gingival health.

One of the crucial aspects of successful esthetic restorative dentistry is controlling gingival contours. Physiologic contours or emergence profiles are important for gingival health, as overcontoured restorations can lead to gingival inflammation (Figure 1).

Controlling the contours of final restorations begins with pre-planning before ever picking up a handpiece and bur. Final 3-dimensional tooth positioning, the type of restoration, and the desired color change from the existing clinical situation dictate tooth structure removal and were discussed in the two previous articles in this series.[1,2] This article will discuss how to control the gingival contours of the final restorations in the laboratory.

Ideally, the ceramist should work on a master cast that has the gingival elements intact (ie, not trimmed away). Many techniques have been discussed, from using a solid untrimmed cast (Figure 2) to using casts that use pink flexible silicone materials (Figure 3) that allow the ceramist to visualize the relationship of the free gingival margin to the cervical contours of the restoration. Both work, but with slight difficulties. The solid cast does not use the actual dies, which makes them impossible to use in a foil or refractory technique. The only way to use this technique is after the dies are divested or removed from the foil; they then must be "fit" to the solid cast. If there are problems with contour or fit it is very difficult to correct. The "soft tissue cast" technique allows the use of the master dies, but the authors and many of their colleagues express dislike for using this material with veneers or anterior crowns because this material is very difficult to adjust. This article will discuss the authors' modified Geller cast technique that allows

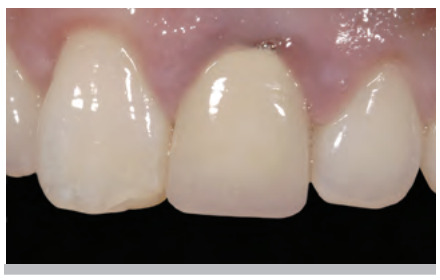


Figure 1 Image of a clinical situation of overcontour with the associated gingival inflammation.

Figure 2 Image of a solid cast without removable dies.

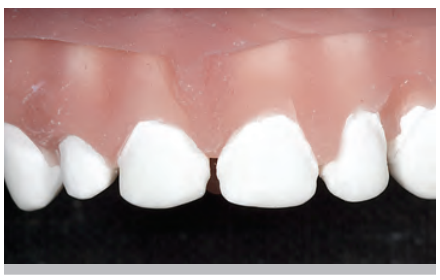


Figure 3 A soft tissue cast with removable dies using the pink PVS impression material for the gingiva.

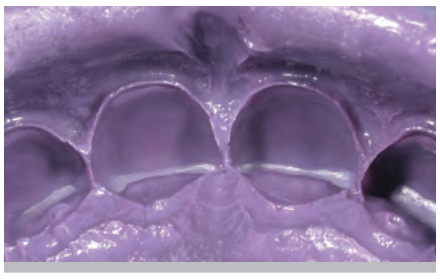


Figure 4 Elastomeric impression with excellent marginal detail.

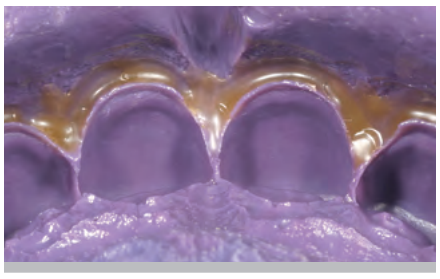


Figure 5 The marginal gingiva is blocked out with wax to support this area so that it does not tear on stone removal.

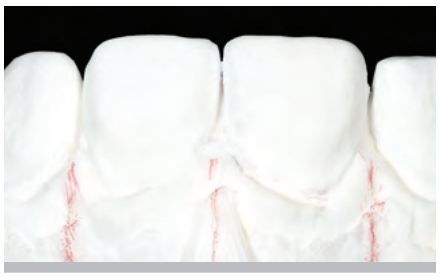


Figure 6 Sectional first pour of the master dies upon removal from impression.

Figure 7 The sectioned dies.

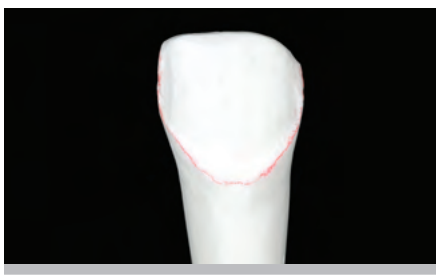


Figure 8 Facial view of trimmed die.

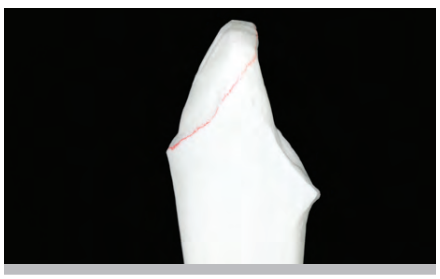


Figure 9 Sagittal view of trimmed die; note that the palatal gingival area is not trimmed away.

Figure 10 The margins are marked, and the dies are sealed and ready for duplication.

Figure 11 The dies are placed in a duplicating ring.

Figure 12 A low-viscosity PVS-duplicating material is poured into the duplicating ring.

Figure 13 The duplicated master die after pouring in die stone and placing one coat of die spacer on the neck or tapered area of the dies.

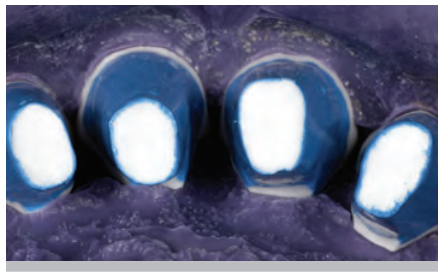


Figure 14 The dies are placed back in the impression and the die lube/separator is placed on the dies.

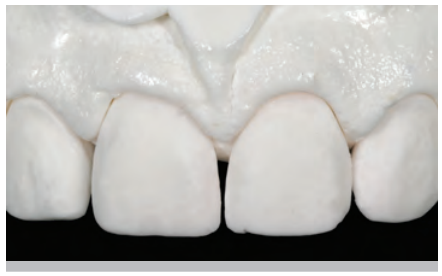


Figure 15 The master cast after it has been poured with die stone.

removable dies and interchangeable refractory dies, and maintains the soft tissue elements in die stone.

TECHNIQUE

Final impressions should be generated with an elastomeric impression material that allows multiple pours, eg, Impregum™ Garant™ Soft Light Body Impression Material by 3M ESPE (St. Paul, MN) (Figure 4). At least two pours of the impression will need to be made. When pouring impressions multiple times, sometimes the marginal area of the impression will tear because of the thinness of the impression material in this area. To avoid this, sticky wax can be built up to fill in where the free gingival margin is; this supports or blocks out the thin area of impression material that went subgingival during the impression process (Figure 5). This will allow multiple pours without tearing. The authors make two master-die pours in this fashion (Figure 6). The dies should be sectioned (Figure 7) and then trimmed and tapered so that there are no undercuts (Figure 8). For veneers, the lingual soft tissue should not be cut away; this helps stabilize the die in the cast and acts as an anti-rotation or seating device (Figure 9). The margins are marked with a red pencil and the dies are sealed (Figure 10). The master dies are then mounted on a duplicating device (Figure 11). A low-viscosity polyvinyl siloxane (PVS) duplicating material should be poured into the ring around the dies (Figure 12).

Next, the duplicated master dies can be die-spaced with one coat of die spacer on the part of the die that is subgingival (Figure 13). It has been found by the authors

ONE OF THE CRUCIAL ASPECTS OF SUCCESSFUL ESTHETIC RESTORATIVE DENTISTRY IS CONTROLLING GINGIVAL CONTOURS.

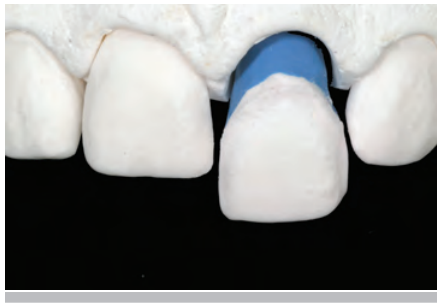


Figure 16 Demonstration of the resolvability of the dies with the intact gingival elements.

TO CREATE INTERCHANGEABLE REFRACTORY DIES FOR THE MASTER CAST, THE ORIGINAL MASTER DIES ARE DUPLICATED, BUT SHOULD NOT BE OTHERWISE USED UP TO THIS POINT. THESE DIES SHOULD BE SPACED WITH THE APPROPRIATE AMOUNT OF DIE SPACER ON THE PREPARATION AREA JUST SHORT OF THE MARGIN.

CHLORHEXIDINE GLUCONATE ORAL RINSE USP, 0.12%

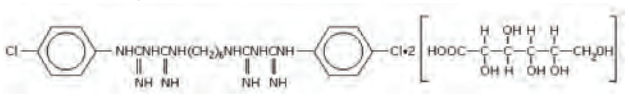
1 Pint (473 mL)

KEEP OUT OF REACH OF CHILDREN

G-U-M®

Alcohol Free

Description: Chlorhexidine Gluconate Oral Rinse USP, 0.12% is an oral rinse containing 0.12% chlorhexidine gluconate (1,1'-hexamethylene bis [5-(p-chlorophenyl) biguanide] di-D-gluconate) in a base containing deionized water, propylene glycol, glycerin, polyoxyl 40 hydrogenated castor oil, mint flavor, potassium acesulfame, FD&C Red #40 and D&C Red #33. Chlorhexidine Gluconate Oral Rinse is a near-neutral solution (pH range 5-7). Chlorhexidine gluconate is a salt of chlorhexidine and gluconic acid. Its chemical structure is:



Clinical Pharmacology: Chlorhexidine gluconate provides antimicrobial activity during oral rinsing. The clinical significance of chlorhexidine gluconate's antimicrobial activities is not clear. Microbiological sampling of plaque has shown a general reduction of counts of certain assayed bacteria, both aerobic and anaerobic, ranging from 54-97% through six months' use.
Use of chlorhexidine gluconate oral rinse in a six-month clinical study did not result in any significant changes in bacterial resistance, overgrowth of potentially opportunistic organisms or other adverse changes in the oral microbial ecosystem. Three months after chlorhexidine oral rinse use was discontinued, the number of bacteria in plaque had returned to baseline levels and resistance of plaque bacteria to chlorhexidine gluconate was equal to that at baseline.

Pharmacokinetics: Pharmacokinetics studies with 0.12% chlorhexidine gluconate oral rinse indicate approximately 30% of the active ingredient is retained in the oral cavity following rinsing. The retained drug is slowly released into the oral fluids. Studies conducted on human subjects and animals demonstrate chlorhexidine gluconate is poorly absorbed from the gastrointestinal tract. The mean plasma level of chlorhexidine gluconate reached a peak of 0.206 µg/g in humans 30 minutes after they ingested a 300 mg dose of the drug. Detectable levels of chlorhexidine gluconate were not present in the plasma of these subjects 12 hours after the compound was administered. Excretion of chlorhexidine gluconate occurred primarily through the feces (~90%). Less than 1% of the chlorhexidine gluconate ingested by these subjects was excreted in the urine.

INDICATIONS AND USAGE: Chlorhexidine Gluconate Oral Rinse is indicated for use between dental visits as part of a professional program for the treatment of gingivitis as characterized by redness and swelling of the gingivae, including gingival bleeding upon probing. Chlorhexidine Gluconate Oral Rinse has not been tested among patients with acute necrotizing ulcerative gingivitis (ANUG). For patients having coexisting gingivitis and periodontitis, see PRECAUTIONS.

CONTRAINDICATIONS: Chlorhexidine Gluconate Oral Rinse should not be used by persons who are known to be hypersensitive to chlorhexidine gluconate or other formula ingredients.

WARNINGS: The effect of Chlorhexidine Gluconate Oral Rinse on periodontitis has not been determined. An increase in supragingival calculus was noted in clinical testing in chlorhexidine gluconate oral rinse users compared with control users. It is not known if chlorhexidine gluconate oral rinse use results in an increase in subgingival calculus. Calculus deposits should be removed by a dental prophylaxis at intervals not greater than six months. Hypersensitivity and generalized allergic reactions have occurred. SEE CONTRAINDICATIONS.

PRECAUTIONS: GENERAL

1. For patients having coexisting gingivitis and periodontitis, the presence or absence of gingival inflammation following treatment with Chlorhexidine Gluconate Oral Rinse should not be used as a major indicator of underlying periodontitis.
2. Chlorhexidine Gluconate Oral Rinse can cause staining of oral surfaces, such as tooth surfaces, restorations, and the dorsum of the tongue. Not all patients will experience a visually significant increase in toothstaining. In clinical testing, 56% of chlorhexidine gluconate oral rinse users exhibited a measurable increase in facial anterior stain, compared to 35% of control users after six months; 15% of chlorhexidine gluconate oral rinse users developed what was judged to be heavy stain, compared to 1% of control users after six months. Stain will be more pronounced in patients who have heavier accumulations of unremoved plaque.
   Stain resulting from use of Chlorhexidine Gluconate Oral Rinse does not adversely affect health of the gingivae or other oral tissues. Stain can be removed from most tooth surfaces by conventional professional prophylactic techniques. Additional time may be required to complete the prophylaxis.
   Discretion should be used when prescribing to patients with anterior facial restorations with rough surfaces or margins. If natural stain cannot be removed from these surfaces by a dental prophylaxis, patients should be excluded from Chlorhexidine Gluconate Oral Rinse treatment if permanent discoloration is unacceptable. Stain in these areas may be difficult to remove by dental prophylaxis and on rare occasions may necessitate replacement of these restorations.
3. Some patients may experience an alteration in taste perception while undergoing treatment with Chlorhexidine Gluconate Oral Rinse. Rare instances of permanent taste alteration following chlorhexidine gluconate oral rinse use have been reported via post-marketing surveillance.

Pregnancy: Teratogenic Effects Pregnancy Category B. Reproduction studies have been performed in rats and rabbits at chlorhexidine gluconate doses up to 300 mg/kg/day and 40 mg/kg/day, respectively, and have not revealed evidence of harm to fetus. However, adequate and well-controlled studies in pregnant women have not been done. Because animal reproduction studies are not always predictive of human response, this drug should be used during pregnancy only if clearly needed.

Nursing Mothers: It is not known whether this drug is excreted in human milk. Because many drugs are excreted in human milk, caution should be exercised when chlorhexidine gluconate oral rinse is administered to nursing women.
In parturition and lactation studies with rats, no evidence of impaired parturition or of toxic effects to suckling pups was observed when chlorhexidine gluconate was administered to dams at doses that were over 100 times greater than that which would results from a person's ingesting 30 mL (2 doses) of Chlorhexidine Gluconate Oral Rinse per day.

Pediatric Use: Clinical effectiveness and safety of Chlorhexidine Gluconate Oral Rinse have not been established in children under the age of 18.

Carcinogenesis, Mutagenesis, and Impairment of Fertility: In a drinking water study in rats, carcinogenic effects were not observed at doses up to 38 mg/kg/day. Mutagenic effects were not observed in two mammalian in vivo mutagenesis studies with chlorhexidine gluconate. The highest doses of chlorhexidine used in a mouse dominant-lethal assay and a hamster cytogenetics test were 1000 mg/kg/day and 250 mg/kg/day, respectively. No evidence of impaired fertility was observed in rats at doses up to 100 mg/kg/day.

Adverse Reactions: The most common side effects associated with chlorhexidine gluconate oral rinse are: 1) an increase in staining of teeth and other oral surfaces; 2) an increase in calculus formation; and 3) an alteration in taste perception; see WARNINGS and PRECAUTIONS. Oral irritation and local allergy-type symptoms have been spontaneously reported as side effects associated with use of chlorhexidine gluconate rinse.
The following oral mucosal side effects were reported during placebo-controlled adult clinical trials: aphthous ulcer, grossly obvious gingivitis, trauma, ulceration, erythema, desquamation, coated tongue, keratinization, geographic tongue, mucocele, and short frenum. Each occurred at a frequency of less than 1.0%.
Among post marketing reports, the most frequently reported oral mucosal symptoms associated with chlorhexidine gluconate oral rinse are stomatitis, gingivitis, glossitis, ulcer, dry mouth, hypesthesia, glossal edema, and paresthesia.
Minor irritation and superficial desquamation of the oral mucosa have been noted in patients using chlorhexidine gluconate oral rinse.
There have been cases of parotid gland swelling and inflammation of the salivary glands (sialadenitis) reported in patients using chlorhexidine gluconate oral rinse.

Overdosage: Ingestion of 1 or 2 ounces of Chlorhexidine Gluconate Oral Rinse by a small child (~10 kg body weight) might result in gastric distress, including nausea. Medical attention should be sought if more than 4 ounces of Chlorhexidine Gluconate Oral Rinse is ingested by a small child.

Dosage and Administration: Chlorhexidine Gluconate Oral Rinse therapy should be initiated directly following a dental prophylaxis. Patients using Chlorhexidine Gluconate Oral Rinse should be reevaluated and given a thorough prophylaxis at intervals no longer than six months. Recommended use is twice daily, oral rinsing 30 seconds, morning and evening after toothbrushing. Usual dosage is 15 mL (½ FL OZ marked in cup) of undiluted Chlorhexidine Gluconate Oral Rinse. Patients should be instructed not to rinse with water, or other mouthwashes, brush teeth, or eat immediately after using Chlorhexidine Gluconate Oral Rinse. Chlorhexidine Gluconate Oral Rinse is not intended for ingestion and should be expectorated after rinsing.

How Supplied: Chlorhexidine Gluconate Oral Rinse is supplied as a pink liquid in 1 pint (473 mL) amber plastic bottles with child-resistant cap, individually shrink wrapped with a dosage cup. Store above freezing (0ºC or 32ºF).

Revised: December 2005

Manufactured for:
Sunstar Butler, Chicago, IL 60630

To open, press down while turning cap. To seal, turn until cap clicks and is tight.

Directions for Use: Fill dosage cup to the fill line (15 mL). Swish in your mouth undiluted for 30 seconds, then spit out. Use after breakfast and before bedtime. Or, use as prescribed by your dentist.

Note: To minimize medicinal taste, do not rinse with water immediately after use.

Ingredients: 0.12% chlorhexidine gluconate in a base containing deionized water, propylene glycol, glycerin, polyoxyl 40 hydrogenated castor oil, mint flavor, potassium acesulfame, FD&C Red #40 and D&C Red #33.

What to expect when using Chlorhexidine Gluconate Oral Rinse:
Your dentist has prescribed Chlorhexidine Gluconate Oral Rinse to treat your gingivitis – to help reduce the redness and swelling of your gums, and also to help you control any gum bleeding. Use Chlorhexidine Gluconate Oral Rinse regularly, as directed by your dentist, in addition to daily brushing and flossing. Spit out after use. Chlorhexidine Gluconate Oral Rinse should not be swallowed.
Chlorhexidine Gluconate Oral Rinse may cause some tooth discoloration, or increases in tartar (calculus) formation, particularly in areas where stain and tartar usually form. It is important to see your dentist for removal of any stain or tartar at least every six months, or more frequently if your dentist advises.

- Both stain and tartar can be removed by your dentist or hygienist. Chlorhexidine gluconate oral rinse may cause permanent discoloration of some front-tooth fillings.
- To minimize discoloration, you should brush and floss daily, emphasizing areas which begin to discolor.
- Local hypersensitivity and sometimes generalized allergic reactions have also been reported. Chlorhexidine Gluconate Oral Rinse should not be used by persons who have a sensitivity to it or its components. Chlorhexidine Gluconate Oral Rinse may taste bitter to some patients and can affect how foods and beverages taste. This will become less noticeable in most cases with continued use of Chlorhexidine Gluconate Oral Rinse.
- To avoid taste interference, rinse with Chlorhexidine Gluconate Oral Rinse *after* meals. Do not rinse with water or other mouthwashes immediately after rinsing with Chlorhexidine Gluconate Oral Rinse.

If you have questions or comments about Chlorhexidine Gluconate Oral Rinse, contact your dentist or pharmacist.

Store at 20º-25ºC (68º-77ºF).

Manufactured for: Sunstar Butler, Chicago, IL 60630

that one coat of die spacer is necessary to compensate for the slight expansion of the refractory die. This die should be sealed, the die separator placed on it, and the dies placed back in the master impression (no wax is used at this point in the

Figure 17 The original master die (the one that was previously duplicated) is die-spaced in the region to receive the restoration.

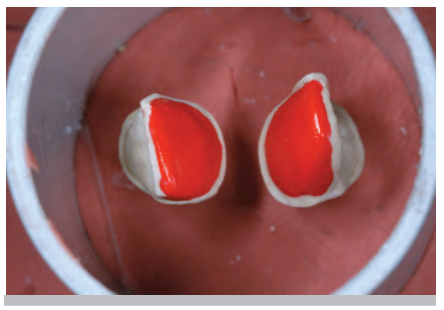


Figure 18 The die-spaced dies are placed back in the duplicating ring and poured with PVS duplicating material as before.

Figure 19 The refractory die generated from duplicating the die-spaced master die.

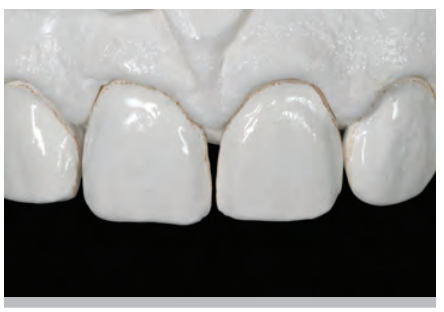


Figure 20 The master cast with the sealed refractory dies in place, ready for porcelain application.

impression so as to reproduce all of the gingival contours in stone) (Figure 14). Die stone is then poured into the full impression around the dies that have been lubricated. The master cast with fully intact gingiva and removable dies is demonstrated in Figure 15 and Figure 16. It can be seen at this point how much easier it would be to visualize correct gingival contours than with a conventional pinned-die technique.

To create interchangeable refractory dies for the master cast, the original master dies are duplicated, but should not be otherwise used up to this point. These dies should be spaced with the appropriate amount of die spacer on the preparation area just short of the margin (Figure 17). The dies can be placed in a duplicating ring and duplicated as before (Figure 18). Note that these dies had no die spacer on the neck or root of the die. The dies that were used in the master cast have one coat of die space on the neck or root to make the socket or hole the die fits in slightly larger than the die. This allows for the slight expansion of the refractory material and allows the refractory die to seat in the master cast properly. Once the master die with die spacer only on the preparation area is duplicated, it is poured with a refractory material that is specific to the porcelain used (Figure 19). The dies will fit back in the master cast and will be interchangeable with the duplicate master dies (Figure 20).

The refractory dies should be sealed with a material that is specific to the porcelain system. The porcelain is built up similarly to other techniques, but as seen in Figure 21, because of the stone replication of the gingival, it is much easier to create esthetic and physiologic contours. Figure 22 through Figure 24 represent the preoperative condition, conservative preparations, and the final esthetic outcome of veneers placed on teeth Nos. 6 through 11.

Figure 21 Using the modified Geller cast during the porcelain application process.

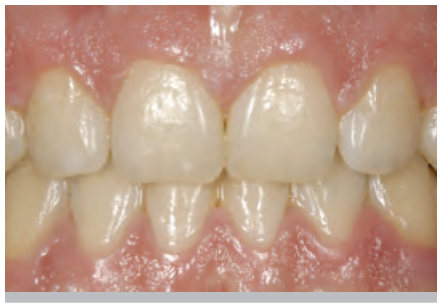


Figure 22 Preoperative condition of the patient used to demonstrate this technique.

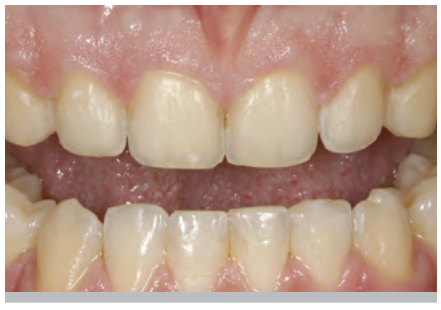


Figure 23 Conservative porcelain veneer preparations.

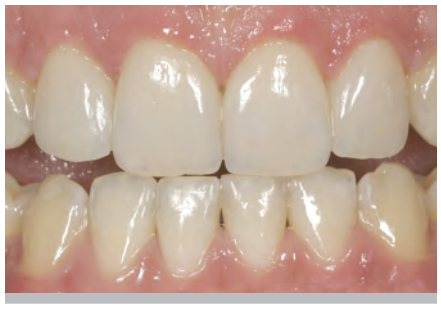


Figure 24 The final esthetic outcome of porcelain veneers placed on teeth Nos. 6 through 11.

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2. McLaren EA, Vigoren G. Preparations and controlling tooth reduction Part 2: Crowns and fixed partial dentures. *Inside Dentistry.* 2007;3(5):86-90.