Non-invasive reconstruction with ceramic veneers—Art or compromise?

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Case 1:
Figs. 1a & b. Exposure of teeth during smiling and a close-up of the stumps before preparation.
Visible enamel discolouration caused by fluorosis.
Figs. 2a & b. A mock-up of the planned restoration made in the patient’s mouth based on a wax-up. Control of smile and occlusion.

My professional evolution proceeded in parallel with the change of the concept of "aesthetics" and the accompanying technological revolutions. By nature, humans are open to novelties, regardless of the correctness of their application. Over time, my professional experience has confirmed the principle that the key to success is thorough planning of each case, detailed diagnostics before commencing work, and the resulting proper selection of materials and procedures. Success is created by efficient communication between the patient, the dentist and the dental technician. Nowadays, patients can use all kinds of media (mostly online) to learn about dental problems they have. In many cases, patient education helps to establish expectations regarding a prosthetic solution. However, we should not forget that we should always realistically assess our reconstructive capabilities in a given case. My experience has taught me that one should not submit to the patient's desires if this interferes with a treatment plan or our feelings. The challenge for the whole team is to achieve a compromise between aesthetics, functionality and the technological possibilities. Achieving a common vision for the restoration ensures ultimate success and satisfaction.

From the beginning of my professional career, I have sought to find a happy medium between my expectations, those of the patient and medical indications, to achieve full health and harmony of the smile. Contrary to appearances, it is an extremely difficult task, and the higher the sense of aesthetics the dentist possesses, the more difficult the task. Patients often come to me with a request to improve their smile and create beautiful teeth. As I have already mentioned, media and often dentists themselves have accustomed patients to the idea that beauty is defined by the whiteness of one's teeth. As a result, the patient does not receive beautiful, natural and functional dentition, but a set of white dentures, often made in a way that does not allow him or her to function efficiently and perform basic hygiene. Frequently, in order to achieve such an effect, tooth tissue...
is permanently lost, which, as we know, can lead
to many, even long-term, complications. We are
primarily doctors and, in achieving patient satis-
faction, we must not forget the overarching objec-
tive, which is treatment, and this must be achieved
by avoiding any harm to our patients. Of course,
“aesthetics” is a relative notion, but it is we who,
from the perspective of our profession and expe-
rience, should shape the aesthetic desires of our
patients and present the best solutions to them.
Our activity in this respect is an art and it should
be treated as such.

In order to attain success in treatment, we
have at our disposal an increasing choice of
modern equipment, technologies and materials.
Each technology requires human input. Contact
with a person of similar sensibility and sense
of aesthetics is essential; with a person who is
able to understand and meet the often-high
demands of the patient and the dentist. This
person is the dental technician, who contributes
equally to our success, the achievement of
which is not possible without complete un-
derstanding. His or her work should also be con-
sidered an art.

In the cases presented, the primary objective
was to achieve the maximum aesthetic effect with
minimally invasive treatment, especially because
the cases concerned young patients. We wanted
our work to be a harmonious and functional ad-
dition to the patient’s smile, adapted to the indi-
vidual case and not a replica of a standard matrix.
In order to choose a method of treatment to
achieve this goal, we considered each case ac-
cording to the following:

(a) case description;
(b) analysis of the white and red aesthetics
   (analysis of the planned restoration aesthetics
   in the context of facial features, lip shape, smile
   lines and characteristics of the patient’s own
   teeth);
(c) analysis of occlusion and articulation;
(d) treatment plan and choice of material.

Figs. 3a–c. Prepared stumps from
teeth 12 to 22. Visible minimally
invasive preparation of the enamel
and no chamfer preparation
of the gingival area.

Figs. 4a–c. Fitting of the finished
veneers showing visible ceramic
shading around the gingival zone
to about 0.1–0.2 mm.

Figs. 5a–f. Comparison
of the veneers before and after
cementation. No visible
veneer–stump junction after
placement. The colour is the result
of the colours of the veneers,
cement and stumps.
Case 1
Case description
A 24-year-old male patient came to the practice for improvement of the aesthetics of his anterior teeth. During the anamnesis, he reported dissatisfaction with the discolouration and shape of his maxillary incisors, but was satisfied with the colour of the rest of his teeth. The patient confirmed endogenous application of fluoride during childhood, which may have been the aetiology of the existing discoulouration. The patient's priority was the least invasive prosthetic treatment with a natural and aesthetic restoration.

Analysis of occlusion
Diagnostic models were mounted in an articulator after facebow registration and centric relation (CR) registration (Dawson's technique). In CR, the first contacts occurred on the palatal cusps of the premolars on the right side. Preliminary equilibration on the models was performed. The correction concerned the premolar palatal cusps (medial slopes) on the right side and then in the same way on the left side, and the buccal cusps of the premolars on both sides (medial slopes) with lateral movements. Equilibration was performed until CR was in accordance with the maximum intercuspal position (CR = MIP) with preserved occlusion and until canine guidance on both sides during lateral movements was obtained. Then intra-oral equilibration was performed similar to the models. The equilibration
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was performed using 14 µm-thick articulating paper with a fine, pear-shaped drill bit (red-coated) mounted on a 1:5 increasing handpiece on a micromotor.

Subsequent to completion of equilibration, the corrected surfaces were polished. Again, diagnostic models were created for the wax-up, and for planning the final scope and type of restoration. On the basis of the wax-up, a mock-up was made in the patient’s mouth to check the function and acceptance of the shape of the restoration (Figs. 2a & b).

Treatment plan

The preparation of feldspathic ceramic veneers on the maxillary incisors (teeth 12, 11, 21 and 22) was planned in order to alter the shape of the incisors, while maintaining the original length and colour of the teeth. Preserving the natural colour of the teeth allowed for application of a more transparent and thus more aesthetically favourable ceramic, since fluoride discoloration is present only within the superficial layer of enamel, which can be removed during preparation. After another clinical analysis, based on the diagnostic mock-up and consultation with the patient and dental technician, it was decided to perform power whitening of the maxillary canines (teeth 13 and 23) in order to make the existing discoloration on the labial surfaces the same colour as the rest of the teeth. This was made possible by predetermining the aetiology of the discoloration to be dental fluorosis. Discoloration caused by demineralisation of enamel would have become even more visible after the whitening treatment.

Maxillary canine whitening was performed selectively using a 16 % BriteSmile preparation (Philips Oral Healthcare) activated by a dedicated light (two sessions of 20 minutes each). The key issue for the mechanics and durability of ceramic veneers is not to cross the amelodentinal junction. Preparation of the stumps was limited to alignment and rounding of the incisal edges and to elimination of the most visible discoloration (Figs. 3a–c). The gingival area was not subjected to chamfer preparation owing to the possibility of shading the feldspathic veneers even up to 0.1 mm. The preparation was performed using a red-coated tip on a 1:5 increasing handpiece on a micromotor with water-cooling. After preparation, the enamel surface was polished with Sof-Lex discs (3M ESPE). Then a double-layer one-step impression was taken with polyvinyl siloxane material (BISCO, Inc.). Because the enamel surface preparation was performed supragingivally, no retraction cord was placed before taking the impression.

Fig. 11. Prepared stumps from teeth 13 to 23. Stump preparation was limited to smoothing the surface of the enamel and the removal of existing composite restorations.
Fig. 12. The finished veneers after being released from the refractory mass.

Figs. 13a–c. Comparison of the teeth before and after treatment.
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Laboratory procedure

After receiving the restorations from the laboratory, their tightness and adherence to the stumps were checked (Figs. 4a–c). In the case of veneers, it is not possible to check the contact surface and articulation before cementation. Therefore, the cementing of each veneer should be carried out separately, while checking the passivity of fit of the adjacent veneer.

It should also be remembered that the final colour of restoration is the combination of the colour of the veneer and of the underlying stump (Figs. 5a–f). Its initial assessment is possible with Variolink Try-in Paste (Ivoclar Vivadent), but the final selection of the colour of the adhesive material depends on the dentist’s experience.

Under rubber dam isolation, the stump surfaces were cleaned with pumice paste, rinsed thoroughly with water and etched with 37% orthophosphoric acid for 45 seconds. Then they were rinsed with a water spray for the same period. After that, the Variolink Veneer light-curing luting composite system was applied. Each time, the contact surfaces of the adjacent teeth were isolated using Teflon insulation tape. In the meantime, the inner surface of the veneers was etched with 7% hydrofluoric acid for one minute, the etching agent was pre-rinsed with a water spray and the veneers were placed in an ultrasonic cleaner for two minutes. The etched surface of the veneers was covered with silane (Monobond Plus, Ivoclar Vivadent), dried and covered with a bonding agent (Heliobond, Ivoclar Vivadent). Variolink Veneer in shade High Value +1 was applied to the etched surface of the veneers, which were placed on the stumps. After excess material had been removed, the veneers were cured for about ten seconds. The restoration edges were smeared with glycerine gel to prevent the formation of an oxygen inhibition layer in the composite. Each surface was irradiated with a curing light at 800 mW/cm² for 60 seconds. Excess composite was removed with a #12 scalpel blade, and polished with strips and bands for polishing composites. Finally, the veneers were checked for occlusion and articulation with 14 µm-thick articulating paper. Corrections were made with a 45 µm smooth diamond-coated tip on a 1:5 increasing handpiece on a micromotor. If any adjustments to the intra-oral ceramics are necessary, it is important to avoid the use of a turbine owing to its very fast speed and the ability to cause chipping or microcracks in the porcelain structure. Finally, the stump-veneer interface was polished with rubber bands and strips for polishing composites (Figs. 6a–c). The outcome of prosthetic treatment was satisfactory to both the dentist and the patient, both immediately and in the long term (Figs. 7a–c).

Case 2

Case description

A 30-year-old female patient came for treatment because of the progressive wear of the masticatory surfaces of the teeth in both the maxillae and mandible. The patient complained about a stressful lifestyle and perceptible excessive masseter muscle strain, even after waking up. She also reported habitual nail biting in stressful situations.
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Analysis of white and red aesthetics

The incisal edges of the maxillary incisors were not visible with the lips in rest position. There was a reverse smile line. The gingival margin of the maxillary incisors and canines was unbalanced (Figs. 8a & b).

Analysis of occlusion and articulation

A slight tenderness of the masseter muscles and medial pterygoid muscles was observed. There were no audible symptoms during abduction and adduction, or during lateral movements. Mandibular movements were within the normal range. During load testing of the mandible according to Dawson’s technique, no pain was observed. There was generalised abrasion of the teeth in both the maxillae and the mandible. No evident points of first contact in CR were present. There were enamel defects on the vestibular surfaces of the maxillary incisors. Initially, bruxism was diagnosed without lesions in the temporomandibular joint.

Treatment plan

An increase in the height of occlusion in CR, a correction of the gingival margin in the anterior zone, and feldspathic ceramic veneers for the maxillary canines and incisors were planned.

CR registration was performed with Dawson’s technique using a wax plate (Bite Registration Wax wafer, DeLar) after 15-minute deprogramming by means of a deprogrammer (Lucia Jig) with a flat surface on the incisors and no contact between the lateral teeth. Facial arch registration was performed and the models were placed in a partially adjustable Artex articulator. A diagnostic wax-up was made, partly reconstructing the worn tissue of the lateral teeth. Incisal and canine guidance was obtained in the anterior section. On the basis of the wax-up, a mock-up was made in the patient’s mouth to obtain acceptance of the shape and length of the incisors and canines, and to check the function (Figs. 9a & b).

Occlusal conditions planned on models were reconstructed in the patient’s mouth with temporary restorations retained for a period of four weeks, and adjustments to occlusion and lateral movements at weekly intervals. After the adaptation period, the temporary restorations were replaced with final ones. Pressed ceramic onlays, crowns with a zirconium dioxide core and direct composite restorations were fabricated for the posterior section. Adjustments to the gingival margin of the maxillary incisors and canines were done with a #15 scalpel blade (Figs. 10a & b) and the effect was maintained by appropriate shaping of the temporary restorations.

Two weeks after correction of the gingival margin, the final preparation for feldspathic ceramic veneers on the maxillary incisors and canines was performed. The preparation was carried out with a red-coated drill in the shape of a rounded cylinder, followed by smoothing with fine Sof-Lex discs (Fig. 11). The preparation was limited to the removal of old composite restorations of Black’s Class V, and to smoothing the facial surface and the incisal edges.

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The impressions were taken according to a double-layer one-step method with polyvinyl siloxane material of two different resiliences (BISCO, Inc.). Gingival retraction was performed using Ultrapak #0 retraction cord (Ultradent).

**Laboratory procedure**

The modern concept of "aesthetics" constitutes a significant challenge in the work of both the dentist and the dental technician. Society's desire to be trendy means not only being associated with fashionable brands, but also emanating a healthy lifestyle. We want our design to attract the attention of others; we want others to perceive the beauty in us. The concept of "beauty" is difficult to define. But it is certain that beauty results from the harmony of shape and colour.

The progressive development of technology in dentistry and dental techniques aids the ongoing elimination of errors and increase in predictability in every area of dentistry. However, many treatments still depend on the artistic work of the dentist and the dental technician.

One area of work in which the technology has remained unchanged for many years is the feldspathic technique of the direct application of ceramics to a refractory mass followed by fusion. This technique offers the best cosmetic results. If we combine it with an artistic shape, we can achieve the full harmony of beauty.

This technique requires above all a perfect initial diagnosis. Why? The feldspathic technology is based on a homogenous structure of fused ceramics. There is no intermediate foundation between the patient's tooth stump and the veneer ceramics as is the case with crowns fused to zirconium dioxide or metal. This means that there are no intermediate steps of control in the patient's mouth. The feldspathic veneer or crown is removed from the refractory mass after sintering. If the diagnosis was not correct and the patient is not satisfied with the work, there is no opportunity for any correction. Therefore, as we have mentioned, this technique, which mimics the beauty of nature, will yield satisfying results if the initial analysis and preparation are accurately performed before the fabrication of the veneers.

Although the physical parameters of the material are unfavourable, restorations made from it—after correct adhesive application—are the least defective type of ceramic restoration. Of course, their application requires the fulfillment of many conditions, in the absence of which the work would fail. Feldspathic restoration can be performed only on incisors with straight chamfer preparation around the perimeter of the tooth. It is important that the patient demonstrate correct incisal and canine guidance, as well as lateral support.

This type of restoration allows a dramatic reduction in the amount of preparation of the patient's tooth. Therefore, we can use it to restore lost tissue and change colour, as well as to successfully correct diastemas and rotate teeth. The obtained values of veneer wall and crown
thickness range from 0.2 to 1 mm. Different wall thicknesses on the same veneer are not recommended with the foundation ceramic veneer technique.

The fabrication process begins with impression taking of the tooth stumps (Fig. 14) in silicone and obtaining duplicates of these stumps in plaster in a refractory mass (Figs. 15 & 16). It is important that the position of the plaster stumps in the model coincide perfectly with the position of the stumps in the refractory mass (Figs. 17 & 18). In order to achieve this, one should use an appropriate polymerisation vessel and removable pins (Fig. 18). Stumps produced in the refractory mass should be baked in a furnace according to the manufacturer’s instructions (Fig. 19). The next step is drawing preparation lines with a pencil designed for withstanding high temperatures (Fig. 20). Then the technician applies glaze to the stumps, creating a glossy surface owing to the ceramic microfilm, to protect them from possible damage. The prepared stumps are then ready for coating with an appropriate ceramic in layers, forming the desired veneer shape (Figs. 21–23).

The most complicated tasks are removing the refractory mass from the thin layer of ceramic and checking the marginal fit on the working model (Figs. 24 & 25). The process requires skill and attention from the dental technician. Structures of 0.2 mm in thickness are very brittle and even the slightest bending can break the veneer. The mass is removed by sandblasting at 0.1 MPa with 50 µm sand. The prepared veneers are then ready to be placed in the patient’s mouth. Careful work will be confirmed by marginal fit and colour compatibility.

After receiving the restorations from the laboratory, checking of the passivity of fit of the veneers on the stumps was performed. Cementation, adjustment and final polishing were carried out in the same way as in the first case. After cementation, the restorations were perfectly integrated with the gingival zone, and mimicked the characteristics and structure of the patient’s natural teeth. The outcome of prosthetic treatment was satisfactory to both the dentist and the patient, both immediately and in the long term (Figs. 26a–d).

**Conclusion**

In both of the cases presented, the patients came to the dental clinic to improve the aesthetics of their smiles with minimally invasive treatment. Owing to proper assessment of the conditions and to the selection of suitable material, the objective could be achieved for both patients. The patients received restorations perfectly harmonised with their own teeth and facial features. In addition, the application of the proper criteria for assessment of the cases and for indications for rehabilitation with feldspatic ceramic veneers ensured the functionality and durability of the restorations, which have been confirmed by several years of observation.