Veneers are the most frequently prescribed aesthetic restorations today. In the thirties Charles Pincus, a dentist in California, gave the go ahead for veneer restorations. They were already being used by film stars to temporarily change their appearance. Ceramic veneers can be offered as the treatment option in a wide variety of different cases such as correcting tooth defects, abrasion, orthodontics, diastema, tooth discoloration, coronal fracture or to adjust occlusion. Before preparing the teeth a complete analysis should be carried out in order to optimize the result. In this way it can be ensured that the teeth being veneered will need only minimal preparation, or in some areas none at all. The teeth being restored with ceramic veneers are prepared between 3 and 30 percent only, whereas in comparison a tooth being prepared for either a full gold or bonded crown will receive a preparation of between 63 and 72 percent. This is somewhat invasive.

Indices: Aesthetic, treatment plan, oral anatomy, model, provisionals, veneers

In figure 1 you can see that the reflection on the teeth is in harmony with the reflection on the gingiva. This gives both the dental technician and the dentist a good opportunity to check the emergence profile to make sure it is the same biotype as the patient. The gingival topography reflects on to the tooth below and on the bone architecture. The “wavy” formation of the gingiva is determined by the shape of the tooth; the basic shape of the tooth – round, triangular or square – further determines the degree of curve in the arched form of the gingiva.

The curved shape of the cervical edge is also categorized by three basic shapes: high, medium or flat. Oval or square teeth show a less visible curve shape on the gingiva than triangular teeth (Fig 2).

The labial thickness of the tissue is classified in thin, normal or thick. On a thin bone and a thin gingiva for example the emergence profile should be built up very flat. The classifications of the gingival biotypes have significant influences on the aesthetic and the long-term stability of the gingiva.

Figs 1 and 2
The reflection on the teeth is in harmony with the reflection on the gingiva. Oval or square teeth show a less visible curved shape on the gingiva than triangular teeth.
Figure 3 shows the cross section of the upper third of the tooth-holding-aperture. This area can be subdivided into three segments: the supra-crestal connective tissue attachment, the epithelia connective tissue and the sulcus. The fibres of the connective tissue attachment string from the bone rim to the cement-enamel-border (in German: ZSG). The epithelia connective tissue goes from the cementenamel-border to the tooth sulcus. A study made by Garguilo and Inger shows the combined biological width of the epithelia and the connective tissue is 2.04 mm. This figure should be taken as a guideline. The dental team has a big responsibility when dealing with a patient who presents with healthy dentition requesting veneers purely for aesthetic improvement.

Who is going to take responsibility in the case of recession of the gingiva or loss of the papilla? Will it be the dentist – or perhaps the dental technician?! Both scenarios are frustrating for the whole team as right from the start this aspect has to be considered in the treatment plan. It must be taken into account that the final result of an extensive treatment could be compromised should the gingiva need correction after the “aesthetic treatment” is finalised. This can prove both time consuming and expensive and often can only be resolved by a specialist.

There are now techniques that can improve the whole appearance; the colour, position, shape and size without the need to prepare the teeth. For example – orthodontic treatment can be done using “Invisalign” or by conventional regulating methods and colour changes can be achieved through bleaching the teeth either at home or at the surgery. Composite restorations are often an attractive and inexpensive alternative as there is no need for the dental technician to be involved. On the other hand dental technicians can make “additional veneers” with no need to prepare the teeth.

As the goal of most patients is to have a younger appearance, aesthetic dentistry also offers a solution by restoring teeth to hide the signs of aging.

The smile can be the most striking feature of the face. This is why the charisma of the patient needs to be in dento-facial harmony. There are solutions in modern dentistry that can fulfil the wish for a youthful-harmonic smile and which also offer better function and oral health at the same time.

The edition “west – Los Angeles Times” (Fig 4) had an interesting article titled “The science and sociology of cheating the clock.” This was about a study carried out in 2004 by the “American Academy for Cosmetic Dentistry” which showed that 40 percent of all participating surgeries experienced an increase of 15 percent in cosmetic dentistry.

In the last five years this figure has since risen to 205 percent (rising rate of Med Spas) – 40 times as much! The figures from all the USA cosmetic surgeries in 2005 showed that in the age group 35 to 50 the figure was 47 percent but in the 51 to 64 age group 24 percent.
First patient case

A 19 year old female patient was referred from her childhood dentist to the surgery of Dr Sheets, Dr Paquette and Dr Wu after having to repair a broken tooth horizontally on several occasions (21). It was unnecessary in this case to use a face/ear bow to take a centric bite registration, because the starting situation needed only slight correction (Figs 5 and 6).

The working process is usually the same: photo documentation of the starting situation (Fig 7), condyle referenced mounted study models for the diagnostic wax-up, silicone putty of the wax-up, preparation help (mask) of the wax-up as well as a provisional. After at least ten days, in which the patient establishes if the function, aesthetics and phonetics work for her, it is “judgement day” for the provisional. Close friends, as well as family, are an influence in the evaluation of the aesthetics of the new tooth. They should all have an opinion after ten days. If after ten days everyone is pleased with the provisionals an impression will be taken and a master model cast. This model will be the base for providing the ceramic veneer.

Model production:
When casting the master model it is necessary to take care with the preparation and also to pay attention to the following points:
- mesial papilla
- distal papilla
- gingival height
- gingival shape
- bone contour
- surface of the gingiva
The result of the ready made restoration is highly influenced by these information points.

About the provisional:
The provisional is made extra-orally on a model. For the impression of the prepared teeth a hydro alginate is needed and for the other teeth an ordinary alginate (Fig 8).
The advantage of this kind of impression is that there is no need to place retraction cords. The alginate speeds up the process of manufacturing the provisional because using a mounting plaster with a higher water ratio, mixed for 20 seconds under vacuum, results in shorter setting time.

The alginate can then be separated from the model without worrying about damaging the cast. The provisional was pressed using the silicone mould taken from the wax-up (Fig 9).

The basic crown should then be cut-back (Fig 10) and stain applied in this case using Gradia colour and then finished with a layer of opalising transparent material “TI” also from Gradia (Fig 11).

When pressing and using the cut-back-technique use acrylic that is one shade lighter.

The advantages in using a PMMA based acrylic such as New Outline or Jet Acrylic is that it makes the handling easier for the indirect veneer method, although nowadays these PMMA based acrylics are considered to be of a past generation. However in comparison with a “bite acrylic” cartridge dispensed material, PMMA does have the advantage of being less brittle.

There is much less likelihood of a crown that is less brittle being damaged when lifting after cementing. The higher development of heat (exothermic bonding reaction) and the higher monomer content of PMMA is not relevant, because the provisionals are indirectly produced.

However, on the other hand an advantage of the new generation of bite-acrylics is the fluorescent characterisation – natural teeth can be copied better. When using the cut-back-technique the labial surface is built up thinly with a fluorescing and an opalescing acrylic. In this way the restoration can achieve much higher quality (Fig 12).

Result:
A good provisional is the best advertising for the whole treatment team.
Layering the ceramic:
- To begin with the horizontal fracture is lengthened with opaque dentin.
- Secondly the labial surface is layered thinly with dentin, to approximately 1 mm below the preparation border.
- After that, using a 1:1 mixture of dentin and proximal-dentin, the inter dental areas are closed. In the cervical area the preparation border is slightly overlaid with a 1:1 mixture of enamel and dentin. Therefore a better chameleon effect is achieved.
- The fourth step makes up the application of the mamelons and enamel depending on the individual patient.

All these steps are controlled at all times with the silicone key. The advantage of the layering technique, compared with pressing, is the thinness of the veneer – added to which, it is possible to built up with different opacities – whatever the demands of the tooth (Figs 13 to 16).

After three months the ready-made veneer fits harmoniously into the oral surroundings (Fig 17). The harmony between light, colour, opalescence, translucence, shape, surface texture and glaze is clearly visible.
Second patient case

The second case was a 29 year old patient (Fig 18) who was unhappy about the gaps between his teeth (Figs 19 and 20). He told us that he was the butt of jokes at school. The aesthetic treatment steps began with bleaching and also a diagnostic wax-up, which was demonstrated to the patient in one session. At the same session a try in of a mock-up was done; this is called “Hollywood Stent”. This mock-up can only be manufactured with the wax-up (Fig 21).

After this the preparation of the veneer was done and the provisionals were produced using the cutback-technique that was previously described (Figs 22 and 23).

After the patient has worn the provisional for a couple of weeks the dentist and the patient evaluate the aesthetics and providing everyone is satisfied an impression is taken of the situation. The impression of the situation of the provisional is not taken on the same day as the impression of the preparation because the gingival information would not be sufficiently precise. If one maintains this protocol there should be no negative surprises on the day the ceramic veneer is fitted (Figs 24 to 31).

The patient had asked for us to close his diasthema and shorten the centrals. For this reason flowable composite was used interdentally for demonstration purposes (Fig 21). To “arrange” the incisal edge a black marker was used. Nothing was changed labially.

This first aesthetic prediction is very helpful for the patient and also for the whole treatment team. The only difference of mock-ups manufactured orally or extra orally is that the silicone matrix is taken either from the mouth or from the model. In this case it wasn’t possible to manufacture an extra-oral mock-up because the teeth had been neither lengthened nor labially changed. When preparing teeth with diastemases it is important to take extra care interdentally, because the existing emergence profile is changed primarily in the interdental area.
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Key dental elements for enhancing an image and/or reproducing the natural look:
- Analysis of the “oral-facial aesthetic”
- Understandable diagnosis and treatment plan
- Creation of a subject treatment protocol: dentist, dental technician, periodontologist, orthodontist etc.
- Re-confirmation of the goals during the treatment course
- Choice of the most conservative treatment for functional and aesthetic goals
- Establishing a real expectation for the patient
Fig 28 The biological tooth width in detail before...

Fig 29 … and after the preparation

Fig 30 The changed emergence profile interdentally is clearly visible when the definitive veneer restoration is done.

Fig 31 A “Japanese trick*” is used here in order to represent an imitation of a surface crack. A very pointed bur, which doesn’t rotate is used for this and is pulled along the crown in the same direction as the line angle of the tooth. The result is shown on the tooth 11 in figure 30.

Quality control necessary to achieve red-white aesthetic results:
- Analysis of the biotype
- Adequate preparation depending on expectation and indication
- Impressions should be free of air bubbles, other faults, blood and salvia
- Proper fitting provisional and therapeutic design of the provisional
- Microscopic fit of the restoration**
- Design of the restoration with respect to the emergence profile
- Shape of the restoration, which needs to fit to the biotype of the patient (see Figs 1 and 2)
- Perfect fixation of the restoration
- Design of the restoration using biodynamic guidelines

*Hiroki Goto
** unwanted ceramic “flags” can prevent good fit and could cause ceramic parts to break off.
**Third patient case**

Case history:
The patient introduced here is a 58 year old woman, who was unhappy with the aesthetics and the function of her fifteen year old restoration.

Diagnosis:
Badly fitting crown edges. Figure 32 shows tissue recession at tooth 21 as well as a restoration class 5. The bone crest has sunk in the area of 22. About 91 percent of all anterior extractions cause significant bone crest defects [1].
The front teeth on the upper and lower are jaw slightly rotated. A temporal mandibular dysfunction has also been diagnosed. The x-ray status in figure 33 shows the situation before the periodontal treatment.

Treatment plan:
We begin with periodontal treatment and the resumption of existing root canal treatment. A regulation on the lower jaw followed by an appliance therapy. Then a soft and hard tissue growth arrangement of an ovate-pontic is carried out. After the preparation the upper and lower teeth are been bleached.

In figure 34 it is clear in the preparation that there are differences visible between the anterior crowns, the canines and the veneer. Therefore an adjustment has to be done that adapts the shape and colour of the veneer to the crowns. Tooth 12 is root treated and discoloured in the root area. Also an old, too deep preparation is visible. The crown rim has been built up with opaque and fluorescent material, so that the discolouration does not have a negative influence on the restoration (Fig 36). Figure 35 gives

* We would like to apologize about the quality of the image. This image is a few years old and there is no original available and therefore a printed image had to be scanned.

** If a “desensitiser” (Gluma) is used after the preparation the contrast within the tooth is stronger and the statement of the photo is more powerful.
Figs 38 and 39 Lateral views of the restoration: tooth 31 is a ceramic veneer, 12 is a bonded ceramic crown, 11 is a ceramic veneer and 21 to 23 have been restored with a bonded ceramic bridge.

Fig 40 Complete front tooth restoration one year after fitting.

Fig 41 We were able to give the patient an attractive smile.

an overall view of the completed situation. Figure 37 shows Arestin. It kills the bacteria that connected to periodontal diseases. This was used especially for the care of the periodontium on tooth 12 after a hygienic treatment.

Please take note of the veneer-onlay preparation in the premolar area in figure 35. In this special case we decided for a bridge with an ovate-pontic, because the starting situation (Figs 32 and 33) would not have allowed an implant based aesthetic solution. Ovate pontics give much better aesthetics and function compared with other pontic designs (Figs 38 to 41) [1].
Fourth patient case

Case history:
This patient had a skateboard accident as a teenager on which the tooth 21 has been traumatised strongly and later lost. The implant was placed at the time when the bone was still at growing stage. This resulted in disastrous consequences, which stopped the growing process in the area of the implant. In 1998 the implant had to be replaced due to a sinus perforation.
The patient was referred to the surgery of Dr Sheets and Dr Paquette, because she was very unhappy with the situation.

Looking closely at figure 42, it is easy to see that the patient has started to get used to a certain habit in order to conceal the defect through miming (Fig 43). It was suggested to the patient to have surgical treatment to correct the hanging lips.

Diagnosis:
- Tooth 11 was restored with a non-aesthetic veneer; mesial recession.
- The implant in the area 21 is stable; the position however is rather insufficient.
- Tooth 22 shows a strong recession mesially, about 6 mm.
- The central line and the tooth angle deviate about 3 to 4 mm (compare figures 42 and 43).
- The patient is very emotional as this shape was caused through an accident.

Treatment plan:
- Manufacture diagnostic wax-up
- Remove the old veneer on tooth 11
- Veneer preparation on teeth 12 and 22
- Impression of the implant position
- Manufacture of a long-term provisional using the diagnostic wax-up as a guide
- Evaluation of the provisional
- Manufacture of the finished restoration
- Treatment with an intra-veinal anaesthetic

In figure 44 the cement-enamel-border of tooth 22 is visible. If one ads 1.56 mm to this border (see figure 3) it would give the physiological course of the gingiva. On top of the strong atrophy in the area 21 there was also a strong discolouration of tooth 11 (Fig 45). It was also very clear to see that the old restoration was difficult to keep clean (Fig 46).
Fig 47
Schematic representation of the veneer of tooth 22. The pink gingival ceramic closed directly with the natural tissue. This way the recession is concealed and the tooth gets an ideal proportion.

Fig 48
On the build up feldspat-ceramic veneer the translucency of the different materials is clearly visible, because of the black background. The ceramic gingiva shows a higher opacity.

Fig 49 The implant crown with “pink tissue” visualises the

Fig 50 This photo has been taken straight after the final fit.

### Product list

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<thead>
<tr>
<th>Indication</th>
<th>Name</th>
<th>Manufacturer/Trade</th>
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</thead>
<tbody>
<tr>
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<td>GC UK</td>
</tr>
<tr>
<td>Plaster</td>
<td>Fuji Rock</td>
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</tr>
<tr>
<td>Ceramic furnace</td>
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<tr>
<td>Metal for the bonded bridge</td>
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<td>Ceramic material in Case 1, 2 and 4</td>
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<td>Ivoclar Vivadent</td>
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Conditions are not always ideal. However in cases like this it is important to generate a clinical and aesthetically acceptable result. The following documented case demonstrates a method showing how the level of the gingiva on veneer cases can be raised optically in the area of a defect by using pink ceramic (Figs 47 to 50).

After the final fit of this unusual veneer restoration the patient had appointments in short intervals in order to check the cleaning ability of the restoration. It turned out that in comparison to the old restoration (Fig 51) the interdental cleaning of the new ceramic restoration (Fig 52) was considerably easier to handle.
Gratitude

I would like to thank Dr Cherilyn Sheets very much for her cooperation working on patient cases 2, 3 and 4, also Dr Jean Wu for working together on patient case 1 as well as Dr Peter Nordland who was responsible for the augmentation on patient case 3. This contribution would not have been possible without working cooperation with each other’s specialities and the knowledge exchange of Dr Cherilyn Sheets, Jacinthe Paquette, Dr Jean Wu and Dr Peter Nordland. Therefore every patient experience is a positive memory. The philosophy of the team is based on the conviction that nothing is impossible.
Literature


About the author
His focus on quality and the aesthetic, combined with a recommendation from Willi Geller, lead Otto Prandtner in 2002 to the surgery of Dr Sheets & Paquette in Newport Beach. It is recognised as one of the best dental surgeries in the USA. Otto Prandtner worked there as laboratory manager of an international team of six people. Before he moved to California he was working for Peter Biekert in Stuttgart. Even there he was working intensively with patients and gave hands-on courses.

Born in Austria he was first educated with Creation Ceramic by an Oral Design member in Salzburg. In addition to his entrance in lecture work in 2004 he also gives courses at the Newport Coast Oral Facial Institute and for Amann Girrbach**. Otto Prandtner gives thanks to Michel and Pascal Magne for recommending him to give a hands-on course on “Anterior Implant Aesthetics” at the IDEA*** in San Francisco in 2009. Otto Prandtner lives and works in Munich, Germany.

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