Minimally invasive porcelain veneers

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Introduction and main complaints

In cosmetic dentistry, we seemed to have fallen out of love with porcelain veneers. The trends in recent years seem to be short term orthodontics and composite bonding. This case report highlights a beautiful indication for porcelain veneers using materials and techniques *du jour* with a good dollop of minimal invasiveness at the heart of it. The patient was a 30 year old who presented complaining of gaps between her upper and lower front teeth. Her main priority was the upper teeth.

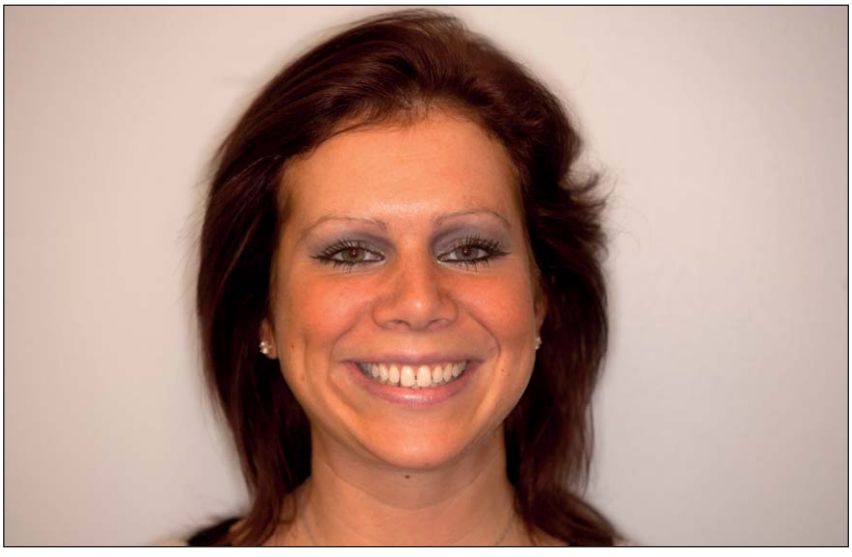

Figure 1

Diagnosis and treatment plan

On the patient's first visit, a preliminary examination was carried out. Radiographs and photographs were taken for treatment planning purposes. No caries was detected and there were no restorations present indicating a low risk for future caries development. Oral hygiene was of a very good standard with no plaque or calculus deposits present. She is a regular attendee to the dentist and hygienist. TMJ and muscle examination were clear.[1]

She was motivated and ready to make a change. As a whole, the patient presented as a suitable candidate for elective dental treatment. *(see Figures 1-12)*

Aesthetic diagnosis: Smile Design

Using the smile analysis described by Orr the following issues were identified:[2,3]

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

Figure 8

Figure 9

Figure 10

Figure 11

Figure 12

- Normal to low lip line
- Smile line in following with lower lip
- Incisal edge position at correct level
- Dental midline co-incident with facial midline
- Height to Width proportion of the upper central incisors are 0.68 (Narrow with respect to ideal of 0.7 to 0.8) and the upper lateral incisors are 0.59
- Multiple diastemas present in between the upper front 6 teeth
- Multiple diastemas present in between the lower front 6 teeth
- Buccal corridors well developed
- Gingival pattern harmonious
- Tooth shade Vita A1.

Treatment plan and consent

Miss RW presented with a well-maintained healthy dentition. There were no functional issues present which boded well for elective dental treatment. To aid with the treatment planning process, I discussed the case with a dental technician I regularly use to gain a second opinion from a technical point of view. There were a few possible ways to tackle this case. The options we presented to the patient were:

Upper arch

1. Orthodontic treatment to redistribute the spaces distally in the arch
2. Six minimally prepared veneers to the upper front teeth to close the diastemas
3. Composite bonding to the upper front six teeth to close the diastemas.

Lower arch

1. No treatment as primary concern was upper arch
2. Orthodontic treatment to redistribute the spaces distally in the arch
3. Composite bonding to the lower front six teeth to close the diastemas
4. Six lower veneers to close the diastemas
5. Orthodontic treatment to evenly redistribute the spaces to allow the placement of minimally prepared veneers on the lower front six teeth.

Treatment option discussion

The patient was made aware of the relative invasiveness of the treatment options presented and of the possible maintenance and longevity associated with the various options. Following this, the patient chose option 2 for the upper arch. She liked the idea of having fuller and wider teeth against the idea of aligned narrow teeth that the orthodontic option would give her.

For the lower arch, due to financial reasons, she chose option 1 for the time being but indicated that she would like to proceed with option 5 when funds allowed.

Her treatment was based upon the APT (Aesthetic Pre-Evaluative Temporaries) technique[4,5] which bases the preparation design with respect to the final tooth position and shape. This ensures an even and equal thickness of preparation meaning a uniform thickness of material. More importantly, it ensures a minimally invasive approach with a preparation predominantly in enamel. The most recent study has shown that in long term studies of veneers prepared using the APT technique, a higher long term success rate is seen when the preparation is in enamel, etched

to enamel and subsequently bonded to enamel.[6] The prerequisite of the diagnostic wax up was to have an additive approach.

During the time between the initial and second consultations, the patient had begun tooth whitening with her own dentist. When she presented to start treatment, her shades were BL3/BL4 using an Ivoclar Chromoscop Shade Guide and B1/B2 using the Vita Shade Guide.

Clinical stages

Records appointment

Silicone impressions were taken using a two-stage technique[7] together with a facebow transfer to create baseline records and to facilitate a diagnostic wax up. A Denar facebow and transfer jig were used in conjunction with a polyvinylsiloxane registration paste (Doric Bite, Schottlander).

The standard set of BACD Accreditation photographs were taken using a Canon 5D Digital SLR using a Canon 100mm macro lens and a Canon MR14EX ring flash. The records (impressions, facebow transfer, bite registrations and photographs) and treatment prescription were sent to the laboratory for processing.

The prescription was for an additive diagnostic wax up. As the tooth proportions are narrow (0.59 to 0.68), we were able to widen the teeth without changing the length whilst creating ideal proportions. Miss RW exhibits feminine extra oral features such as voluminous lips and curves. By widening the teeth, round line angles, open curved embrasures would create a smile in fitting with the patient's features.[8]

Another issue discussed with the technician was of how many teeth to restore? The diastemas were in between the front six teeth. On one hand, taking into account the patient's age and unrestored state of her teeth, we would be thinking on the basis of being minimally invasive. On the other hand, the notion of treating six anterior teeth is not without its own aesthetic complications of underdeveloped buccal corridors.[9] We decided that as the upper front six teeth were proportionately small already, we would initially create a wax up on these teeth. Depending on how they looked via a direct wax up transfer would dictate whether or not we would plan to include the first premolars in the treatment plan. As the palatal surfaces and lower incisors were to be untouched during the treatment process, this would put this case in the simple category.[10] Even though no occlusal changes were to be made, a facebow was used to minimise the risk of any midline or occlusal plane cants on the wax up.

Review appointment

Once the wax up was received, it was re-evaluated prior to the review appointment. Using the same criteria as our initial diagnosis, the wax up was found to be highly satisfactory and no changes were proposed. The patient was invited to a review appointment for her to assess the wax up. These were shown to her on a Denar articulator and met with her approval.

A putty stent was used to transfer the wax up intraorally using a temporary crown and bridge material (Quick Temp, Schottlander). This was done without using any adhesive, to ensure easy removal. The intraoral mock up was assessed for shape, length, position, function and phonetics. No amendments were made. The patient was very happy with the proposed changes. The number of teeth treated appeared to look harmonious with the rest of her smile and extra oral features. The upper front six teeth did not look overwhelming or overpower her buccal corridor. The patient was happy with the proposal of treating just these teeth. The height to width ratio of the central incisors was now 0.74 and the laterals were now 0.65. The organic change in ratio had given a fuller appearance to her smile. Careful removal of the intraoral mock up allowed us to appraise the relative thickness of the material. From this, I was able to assess the relationship between the preparation and final tooth shape and contour.

Prior to the preparation appointment, the case was discussed with the technician. The main points were a review of the intraoral mock up and thickness of material/ preparation. We discussed the material choice for the final case and decided upon IPS E.Max (Ivoclar). This was chosen because of the technician's skill set and predictability in the final result. As the colour of her teeth was towards the high value end already, we would use a high translucency ingot to allow the natural colour of the underlying tooth to show through.[11]

Preparation appointment

Local anaesthetic (Septanest Articaine 4% + 1:200,000 Adrenaline, Septadont) was administered via buccal infiltration using The Wand STA (DPS). An Optragate (Ivoclar) dam was placed for soft tissue retraction.

A preoperative tooth shade (Vita B1, BL3/BL4 Ivoclar Chromoscop) was taken prior to preparation using a TruShade (Optident). As the preparations were anticipated to be in enamel, a pre-operative shade would eliminate any false readings following desiccation related to tooth isolation. A preoperative impression of the upper arch was taken using Doric Easy First (Schottlander). Dental loupes were used for the treatment (4x Orascoptic).

Preparation guides were used to assess and plan the preparation. As this was an additive case, the amount of preparation required was minimal and in the enamel layer. No aesthetic pre re-contouring was necessary4. A facial and palatal guide was used to assess this.

As per the technique described as the APT Technique,[4,5] the wax up was transferred intraorally using a temporary crown and bridge material. I chose Quick Temp Shade A3 (Schottlander) to allow contrast and visibility between the tooth and material. Using a pencil, the intraoral mock up was marked in three planes: cervical, mid-body and incisal. Using a 0.5 mm Depth Cut Bur (M270, Schottlander), cuts were made into the intraoral mock up over the pencil lines. The depth cuts were assessed for thickness and area of

Figure 13

Figure 14

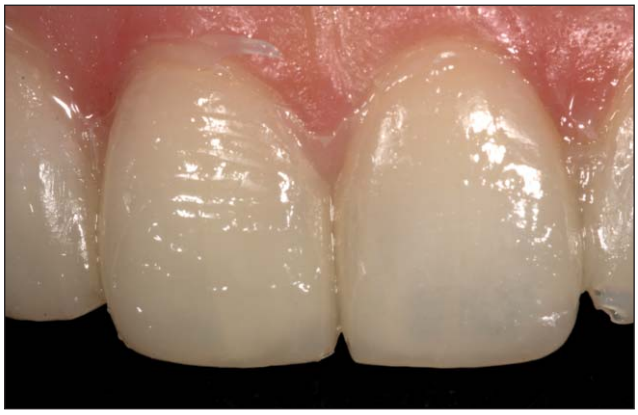

Figure 15

Figure 16

Figure 17

Figure 18

preparation. It was easy to see the cuts were still within enamel. *(see Figures 13-17 and Figures 18-22)*

A pencil was used again to mark into these prepared areas. For the final preparation, a round ended tapered dual grit diamond bur (Komet 6844, West One) was used to prepare into the wax up. This has the benefit of having a medium (red) grit at the tip and a coarse (green) grit on the shank. Once the pencil marks were gone, the preparations were appraised using the facial and palatal preparation guide.

Figure 19

Figure 20

Figure 21

Figure 22

Figure 23

Figure 24

Figure 25

Figure 26

Figure 27

Preparation refinement was achieved using the same bur in a speed increasing hand piece and medium polishing discs (Super Snap Rainbow, Shofu). An interproximal finishing strip (fine and medium grit) (Komet WS37F and WS37EF, West One) was used in the contacts between the laterals/canine/first premolar to smooth any edges as well as allow a thin amount of impression material to flow through to aid the technician.

Clinical photographs were taken of the preparations to assess on a large computer screen (iMac, Apple) prior to final impressions. The views were using a mirror to assess the path of insertion and any undercuts from an occlusal aspect as well as 1:1 ratio images using a cropped DSLR (Canon 450D).
(see Figures 23-27)
By using the APT Technique, the final preparations were in enamel. The margins were supragingival following gingival contours. The teeth were polished and cleaned. Preparation shades were taken using TruShade (Optident) using a hand drawn shade map and clinical photography. The shades were similar to the pre-operative measurements (Vita B1, BL3/BL4 Ivoclar Chromoscop).

Expasyl (Kerr) was used around the preparations. It was initially syringed around the margins and a pre operative impression was reinserted over this to compress the Expasyl into the sulcus to aid retraction. This was washed off afterwards. A working impression of the upper arch using a two stage technique was taken using Doric Quick Time (Schottlander) in a stock tray (Orthodontic Impression Trays, Orthocare). A separation wafer (Doric, Schottlander) was used for the heavy body preliminary impression. Bite registrations using Doric Bite (Schottlander) were taken. The impression was checked under magnification and light prior to approval.

Temporisation

To enable the patient to appreciate and appraise the aesthetic changes, the provisional restorations placed would be based upon the diagnostic wax up.[12,13]

Small areas of etch (Spot Etch Technique) were placed on the facial aspects of the preparation toward the gingival margin. These were left for 15 seconds and washed and dried. A fifth generation single bottle bonding agent (Prime and Bond NT, Dentsply) was used over the whole prepared surface. A thin layer was used with any excess blotted off using a dry microbrush. This was air dried and light cured.

The putty stent based upon the wax up was checked and cleaned using a cotton pellet with alcohol following

its use earlier in the appointment. Once dried and ready, Quick Temp shade B1 (Schottlander) was syringed into the stent and over the preparation margins. The stent was seated into the mouth using positive pressure. The excess material which flowed out of the upper parts of the stent was a guide to whether the material had set. The excess, once cured, was carefully removed and the stent was gently eased off.

The provisional restorations were bonded upon the preparations. Initially, any excess flash and material were carefully removed using hand scalers. The margins were assessed under magnification and by the use of a periodontal probe. Due to the nature of the putty stent, minimal finishing was required. An occlusal assessment was made using 40 micron articulating paper (Bausch) and no adjustment was necessary. The provisionals were cleaned and polished using a rubber polishing brush (Jiffy Brush, Ultradent) and glazed using Quick Temp Glaze (Schottlander). An impression of the provisional restorations was taken using Doric Easy First (Schottlander). Postoperative photographs were taken. Postoperative instructions were given to the patient. Peroxyl (Colgate Palmolive) was given for the patient to use between appointments.

Lab work preparation

The impressions were disinfected and stored in sealed bags. The laboratory prescription was written and the technician was advised to pour models for now, and wait until the review appointment. A USB Stick with images of the case (pre operative, shades, preparation and provisional restorations) was sent with the case. Preparation shades and a shade map were sent with the prescription.

Provisional restoration review appointment

The patient was called a few days after the preparation and she was doing well. There was a general feeling of tiredness after the long preparation appointment but otherwise no major issues with sensitivity or tenderness. A review appointment was arranged 10 days after the preparation to assess the provisional restorations.

The provisional restorations were assessed using the same criteria as the initial diagnosis.[2,3] The patient was very happy with appearance (shape, position and contour) and colour. On examination, gingival health was very good as the preparations were supragingival. An occlusal assessment was done but no adjustments were necessary. Clinical photographs were taken and shown to the patient to discuss the final restorations.

We discussed the case by going through the images on the screen. The patient exhibited small areas of hypo-calcification on the first premolar cusp tips. She was asked as to whether or not she would also like this effect on the canines and she declined. Shades and colour mapping were discussed using Smile Design and the clinical photographs.[14] The patient was keen on having natural effects in the final veneers. The final colour chosen was to be Vita B1. This information was conveyed to the technician via email, photographs and a telephone conversation.

Laboratory work

The case was to be made using IPS E.Max (Ivoclar). The technician was advised to copy the provisional restorations based upon the original wax up. No changes were to be made. The ingot used was a High Translucency BL3/BL4. The veneers were made to full contour and a cut back technique was used to inlay incisal edge effects.

Fitting appointment

Once the veneers were back, they were tried on the models and assessed for fit and appearance (shape, position, contour). Pictures were taken at 1:1 ratio using a crop body DSLR (Canon 450D) to check for marginal fit. The preparation guides were used against the veneers to assess correlation to the wax up. I was very satisfied with the laboratory work.

Local anaesthetic (Septanest Articaine 4% + 1:200,000 Adrenaline, Septadont) was administered via buccal infiltration using The Wand STA (DPS). An Optragate (Ivoclar) dam was placed for soft tissue retraction. A rubber dam was not used as we were able to obtain very good levels of moisture control and access with the Optragate dam. The provisional restorations were checked for any changes (wear, chips, general condition) and they looked good. These were carefully removed due to their very thin nature. A short fine flame bur (F397, Schottlander) was

used to score through the Quick Temp and a Brassler Crown Spreader was used to carefully remove the provisional restorations. Hand and ultrasonic scalers were used to remove any smaller remnants.

The preparations were then polished using a rubber polishing brush (Jiffy, Ultradent), cleaned using chlorhexidine and a cotton pellet, with extra care being taken at the gingival margins. The teeth were then washed and dried.

Figure 28

Figure 29

Figure 30

Figure 31

Figure 32

The veneers were first tried in dry to check the marginal fit. A fine probe was used to assess marginal integration. 1:1 ratio pictures were taken on a cropped body DSLR (Canon 450D) to review on a large screen to verify marginal fit. The marginal fit was very good. The veneers were tried in individually and together to assess any interproximal interferences of which there were none. They were tried in again to assess a cementation order. *(see Figures 28-32)*

The veneers were then removed and tried in using water to assess colour. Due to the thin nature of the veneers, they became semi translucent with the use of water. The colour match and integration was very good. The overall look of the veneers was highly satisfying. Pictures were taken and a mirror was used to allow the patient to review the veneers prior to cementation. The patient gave approval for final cementation. The fit surface was etched using Porcelain Etch (9% Hydrofluoric Acid, Ultradent). A silane primer was used (Monobond Plus, Ivoclar) to prime the veneers for the bonding agent (OptiBond FL Adhesive, Kerr). A thin layer was placed and any excess was blotted off using a dry microbrush.

The cementation order as assessed during the try in was to cement the centrals first followed by left lateral and canine followed by right lateral and canine. The central incisors were etched using Phosphoric Acid 35% (Ultradent) and washed and dried. Prime and Bond NT (Dentsply) was applied to the preparations and dried and light cured. Translucent Variolink II (Ivoclar) was used a light cure only cement. The cement was placed into the veneer and was gently placed over the prepared tooth. Excess was removed using microbrushes. Short bursts of light cure were used to cure the cement around the margins to aid easy removal (Ivoclar Vivadent).[15]
During the cementation on the upper right central, too much pressure was applied in the cervical region creating a marginal fracture. The fracture was clearly visible being just distal of the gingival zenith. It was about 3mm in length. A decision was made to re-prepare the two centrals to obtain the best end result. The cemented veneers were carefully drilled off to ensure the preparations were kept in enamel only.

Once tooth was clear of veneer and cement, new impressions were taken as per the preparation visit. Provisional restorations were placed as per original preparation visit. The case was sent back to the laboratory for the remake of the upper central incisor veneers. Fortunately the patient was very understanding about the scenario.

Once the remade veneers were back, they were checked and the fitting was redone as per the original appointment outlined above. The veneers were fitted in twos, i.e. centrals first, left lateral and canine followed by the right hand side. The cement was cleaned up as they were bonded in to minimise the work required in the final clean up. Hand scalers were used to clear the margins of cement, floss (Glyde) and interdental separation strips (Komet,

Figure 33

Figure 34

Figure 35

Figure 36

Figure 37

West One) were used in the interproximal areas.

The veneers were initially tacked in place with spot curing. Once clean up was complete, a final cure was carried out. De-Ox (Oxygen Barrier Solution, Ultradent) was used around the margins in the final cure.

An interproximal finishing strip (fine grit) (Komet WS37EF, West One) was used in the contact areas. Exposed margins were polished using a fine disc (Super Snap Rainbow, Shofu) and a rubber polishing brush (Jiffy, Ultradent).

Occlusion was checked using 40 micron articulating paper (Bausch) and no adjustments were necessary.

Postoperative instructions were given. The patient was very happy with the initial result. *(see Figures 33-37)*

Review appointments

The patient was seen initially at 10 days after the initial appointment. Miss RW was very happy with the outcome.

There were no postoperative symptoms following the previous appointment. Postoperative radiographs were taken to assess fit and some remnants of cement were seen and subsequently cleared.

The patient was reviewed at 8 and 17 weeks after the fitting to assess soft tissue integration and maturation. Gingival tissue maturation and papillary infill at this stage has really created a beautiful end result. She was seen by the hygienist to start her on-going care and maintenance of her new smile.

The final postoperative clinical photographs were taken at the 17 week review. The patient was very happy with the end result. *(see Figures 38-49)*

Figure 38

Figure 39

Figure 43

Figure 40

Figure 45

Figure 41

Figure 47

Conclusion and personal reflection

An excellent aesthetic outcome was achieved for the patient who was very happy with the end results. The patient has felt an overall increase in confidence in herself and feels better for having been through the process.

The salient feature of this case exhibited that veneers, when done in a minimally invasive manner, can produce a beautiful natural looking result. Not only was this minimally invasive in the actual material thickness and degree of preparation, but also in the number of teeth treated. I believe, that had this patient undergone orthodontic treatment, the final result would not have looked as good or beautiful as it does with this result.

The patient's curves and voluptuous features sit well with the teeth that appear when she smiles. Porcelain veneers, when done in a manner that reflects today's materials and techniques, still can provide a valid and exciting treatment option.

Figure 45

Figure 46

Figure 47

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Figure 48

Figure 49