How to improve the longevity of porcelain veneers.

1. Avoid finishing on a resin composite restoration.

   - Although tempting in the interests of minimal tooth removal, finishing a porcelain veneer preparation on a resin-based composite restoration is not advisable.

   Why? Because the join between a porcelain veneer and an existing composite restoration is a major weak link in veneer longevity. It can be a site for marginal leakage, crack formation and marginal defects.

   This is now supported by a number of clinical reports and studies.\textsuperscript{1, 3, 4} It appears that over time, as a result of stress, there can be a breakdown in the bond between a porcelain veneer and the adjoining composite. This has been attributed, in part, to the frequent expansion and contraction of the composite during temperature changes accompanying the intake of hot and cold foods and drink. Although not of a high magnitude, over a period of years this can be enough to rupture the seal between the two materials.\textsuperscript{1, 5}

   In addition another factor is the inability of a veneer-luting resin to bond as well to composite as it does to enamel. The resin in the surface of a previously placed composite does not form particularly strong bonds with the luting resin. Consequently, with continuing stresses the bond that does exist can become fatigued and break.\textsuperscript{1}

   There are options to finishing on a composite restoration and these are shown on the following page.

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One of the factors contributing to longer-term weakness in the join area appears to be the continuing expansion and contraction of the composite restoration during temperature changes associated with the intake of hot and cold foods and drinks. The coefficient of thermal expansion of composite is over twice that of porcelain.

Luting resins for porcelain veneers do not form very strong bonds with existing resin-based composites and can be another factor in the longer-term breakdown at the join.
How to improve the longevity of porcelain veneers. (cont)

1. Avoid finishing on a composite restoration. (cont)

   - Options

   1. If a tooth has 2 or more large composite restorations consider a full crown. This is particularly so if transillumination shows crack lines in enamel and there is evidence of wear facets on the tooth.

   2. With one medium to large composite restoration on an approximal surface consider taking the approximal surface finishing line further distally. This type of ‘wrap around’ reduces the bulk of the composite and therefore lessens the effect of thermal stresses on the veneer-composite margin.

   3. As an alternative to (1) and (2) above place a resin direct laminate veneer. These materials are not as rigid as porcelain and so have a greater flexibility during function.

   4. With a smaller Class III or IV resin-based composite restoration, replace the restoration at the time the veneer is placed. This gives the new composite the best chance of bonding to the porcelain veneer as well as the tooth tissue.

   The procedure involves removing the old composite before the veneer is attached to the tooth. However, this does make the procedure for bonding the veneer quite complex and technique sensitive.

   After the veneer is luted in place, the excess luting agent is removed from the cavity preparation before the material polymerises. Once the luting agent has polymerised, a composite is inserted into the prepared Class III or IV cavity in the usual fashion.

   Another problem with this approach is that it is difficult to avoid overhanging margins. Care has to be taken to identify and remove them.

   As outlined above, the principal of maximum wrap around in the proximal area is useful for handling the problem of existing approximal-surface composite restorations. This type of design provides a butt incisal overlap of porcelain and has performed well in stress-analysis studies.

   The design is frequently employed when a veneer is intended to close a diastema.
How to improve the longevity of porcelain veneers. (cont)

2. **Avoid finishing on dentine.**

Areas of exposed dentine, especially in the cervical region, are potential weak spots. The flexure of dentine during function can place stresses on the bond between veneer and tooth and result in marginal leakage, crack formation and marginal defects. 1, 6, 7

Abfraction-type stresses exert their main effect in the cervical area and have been cited as a main cause of veneer failure in this region. 1, 6, 7

The rigidity of porcelain is approximately 6 times greater than that of dentine so it is not difficult to see how stresses can be placed on the dentine-porcelain veneer bond in critical areas. 2

If a veneer does finish on dentine, the patient should be warned of the limitations of this approach.

3. **Keep an enamel base and periphery wherever possible.**

Porcelain veneers are essentially ‘enamel-only’ restorations. A predictable and highly stable bond can be achieved with an etched enamel surface.

The presence of enamel provides the necessary unyielding base for porcelain veneers with their low tensile strength. Although not quite as rigid as porcelain, enamel is far less elastic than dentine or resin-based composite.

In a standard-type preparation, enamel is removed to a depth of about 0.5 to 0.7 mm in the mid-facial area to a depth around 0.4 mm in the cervical region. 3

A periphery of enamel around a veneer provides an ideal surface for a lasting seal.
Because the amount of tooth structure removed in porcelain veneer preparations is so small it is easy to get variations in depth in different sites.

Even with experienced operators, the tendency is to under prepare the middle to incisal sections of a facial surface and expose dentine in the cervical and approximal areas.\(^9,10\)

Areas where insufficient tooth structure is removed may eventually be covered by a veneer which is too thin. This can lead to stress concentration in the area and so be a site for subsequent crack formation.\(^10\)

For veneer longevity it is desirable that its thickness be adequate and relatively constant. If at any site the ratio of the thickness of the veneer to the thickness of the luting resin layer is less than 3 to 1 (see next page) then it could be a focus for subsequent problems.\(^11\)

To achieve a uniform depth of enamel reduction the use of some form of depth mark is advisable. Burs that prepare horizontal grooves in a facial surface are available. However, another technique is to prepare pits approximately 0.5 mm deep using a 1 mm diameter round diamond bur. The bur is sunk to half its depth at various sites on the facial surface.

Using a straight-sided, torpedo-shaped diamond bur the facial surface is then reduced to the level of the base of each pit.\(^3\)

A veneer of uniform thickness (a) is better able to withstand the stresses placed on it when the attached luting resin shrinks during polymerisation. If there has been insufficient labial reduction and the veneer is too thin (b) then these polymerisation stresses can cause cracking in the veneer.

One method of achieving a uniform reduction of enamel on a facial surface is to prepare several pits approximately 0.5 mm deep with a 1 mm diameter diamond bur. Then, using a straight-sided, torpedo-shaped diamond bur, reduce the facial surface to the level of the base of the pits.
5. **Allow for minimal luting resin thickness.**

Luting resins bond well to an etched and silane treated porcelain veneer surface. As a result stresses are set up in the porcelain as a result of polymerisation shrinkage of the bonding resin.\(^{11}\)

If the thickness of the bonding resin is too great in relation to that of the veneer the stresses can be such that the veneer cracks.\(^{1, 11}\)

Detailed laboratory studies have shown that this problem can be minimised if the ratio of the thickness of the veneer to that of the luting resin is greater than 3 to 1.\(^{11}\)

Therefore any tendency to compensate for inaccurate fit by the use of excessive die spacer and/or thickening the layer of luting resin should be avoided.

To minimise the possibility of cracks from shrinkage of the luting resin, the luting resin layer should be as thin as possible. In addition, the porcelain veneer should be at least 3 times as thick as the luting resin layer.

6. **Finish any palatal extension as a butt joint.**

Longer-term studies show that there is no significant difference in the longevity of veneers with incisal edge coverage to those without.\(^{12}\)

One indication for incisal edge coverage is the need to make a tooth longer. In such circumstances it is better to finish the palatal extension as a butt joint.\(^{1, 2}\)

Veneers with a long incisal overlap on the palatal side tend to show more cracks and defects in this area.\(^{1}\) Although these defects may be easily repaired with resin-based composite, a butt-join preparation gives the veneer a greater bulk of porcelain and so a greater resistance to these problems.

A butt-join as shown in (a) provides a greater bulk of porcelain than the incisal overlap design shown in (b). The latter design is more prone to cracking and fracture.
How to improve the longevity of porcelain veneers. (cont)

References