Bridge design, part six: cantilever bridgework

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In the sixth installment of his series, Paul Tipton examines a consevative but successful form of bridgework - anterior and posterior cantilevers

Schwartz's study of 1970 showed the cantilever bridge and anterior six unit fixed-fixed bridge to be the longest surviving bridges. Cantilever bridgework is often more conservative and less costly to the patient as fewer teeth are involved in the restoration. This paper now describes cantilever bridge design criteria.

ANTERIOR CANTILEVERS

One of the most successful types of bridge design has been the two-unit cantilevered bridge, one pontic being retained by one abutment tooth. This design is often the choice when using a canine tooth as the only abutment to replace a missing lateral incisor (Figures 1 & 2). The advantages of this type of bridge design are shown in Table 1.

Anterior cantilever bridgework replacing a single incisor can be more widely used than the traditional canine/lateral incisor combination as it is very simple and conservative. Cantilevering a lateral incisor from a central incisor, or central incisor from another central incisor are simple restorative procedures as long as the occlusal scheme is properly organised (Figures 3 to 5).

OCCLUSION

Both pontic and abutment tooth should have intercuspal holding contacts (the pontic having a light holding contact), but only the abutment tooth and neighbouring natural teeth should provide any lateral or protrusive guidance. There should be no guidance on the pontic reducing the likelihood of rotational forces over-stressing the abutment tooth and leading to orthodontic movement with loss of contact point and aesthetics (Figure 6). The biting force anteriorly has been shown to be much less than the biting force posteriorly (Lundgren & Laurell, 1986) reducing further the stress on anterior cantilever loading. The retainer of choice is usually the full crown preparation for aesthetics, but when aesthetic demands are not a requirement the three-quarter crown should also be considered (Roberts, 1970) or the adhesive wing (Maryland) with preparation (Burgess 1989).

TABLE 1 - ADVANTAGES OF A TWO UNIT CANTILEVER BRIDGE

- A conservative approach, as only one tooth requires preparation.
- Reduced cost due to reduced preparation time in surgery.
- Lower material and laboratory costs.
- Improved aesthetics, as less labial surfaces require porcelain restoration.
- Less teeth for failure to occur on

Figure 1: Missing lateral incisor

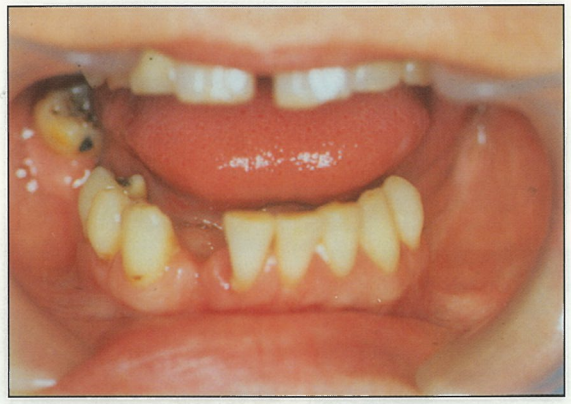

Figure 2: Single cantilever bridge, lateral incisor from a canine

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Figure 3: Missing central incisor

Figure 4: Contralateral central incisor tooth preparation

Figure 5: Single cantilever bridge, central incisor from another central incisor

Figure 6: Guidance on abutment and adjacent teeth but not on the pontic

POSTERIOR CANTILEVERS

In order to cantilever a pontic in the posterior areas of the mouth a secondary abutment is usually required to reduce the excessive vertical loading which can lead to loss of stability due to tipping. This tipping force could lead to orthodontic movement and loss of occlusal stability. Proper preparation techniques to increase and maximise the resistance and retention form are therefore essential in this type of bridgework. This often includes the incorporation of grooves in the buccal and lingual surfaces (Tjan, 1981) (Figures 7 to 9). However, as Schwartz (1970)

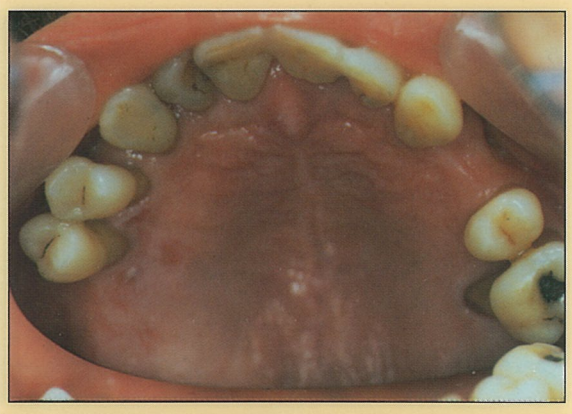

Figure 7: Missing first molar (UR6)

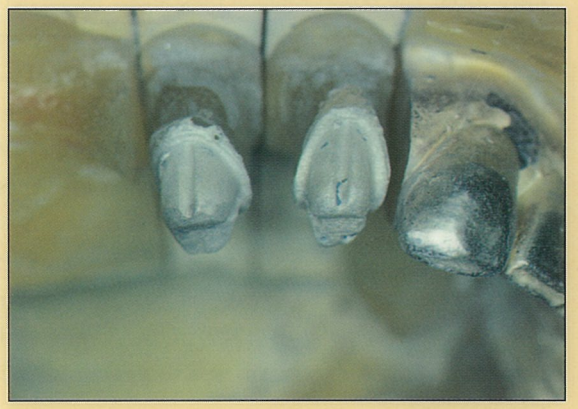

Figure 8: Tooth preparation for posterior cantilever

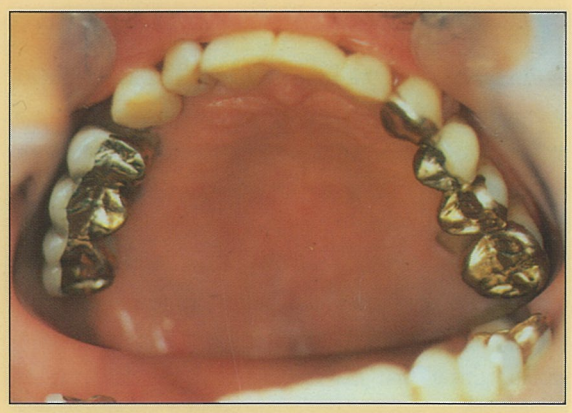

Figure 9: Posterior cantilever bridge, molar from two premolars

Figure 10: Tooth preparation for posterior single cantilever

Figure 11: Occlusal view showing silver die and grooves

Figure 12: Posterior cantilever bridge on model

Figure 13: Occlusal view showing matt gold occlusal surfaces

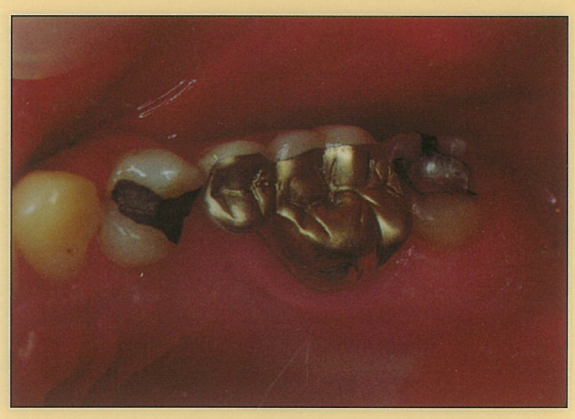

Figure 14: Posterior cantilever bridge, premolar from a molar

has shown there is the added risk of failure with splinted abutments as the cement lutes will have excessive stress placed on them. Single posterior cantilevers are therefore an alternative in some clinical situations (Figures 10 to 14).

Lundgren and Laurell (1986) have shown that the distal cantilevered unit was subjected to forces less than half of those over the contralateral end abutment side. It would appear that occlusal overload on this type of bridgework is prevented by periodontal proprioceptive input and in cases of multi-unit cantilevered pontics, the biting force is severely reduced. Lundgren suggested that this lack of biting force is compensated for by an increased number of chewing strokes and longer chewing period.

OCCLUSION

Laurel (1992) tested the type of occlusal contact on the end pontic in the posterior cantilever bridge by making the contact 80 microns supraocclusal or 80 microns infra-occlusal. Not surprisingly when in supraocclusal contact greater stress was distributed to the end abutment tooth. The proprioception mechanism would normally mean that if excess occlusal force was transmitted to this retainer this excess stress would be detected via receptors in the pulp tissue and periodontium culminating in central feedback changing the chewing pattern. If, however, the terminal end abutment is root-filled then the receptors in the pulp are missing and central feedback may not be as efficient, and excess stress may then be transferred to the abutment. This has been seen in Lindhe and Nyman's bridges (1979) as the increased risk of fracture of the end abutment next to a pontic when it was root-filled.

Laurel therefore suggested leaving the occlusal con-

tact on the posterior distal cantilever pontic in infra-occlusion by 80 microns. This however will normally lead to over-eruption of the opposing unit (unless splinted or part of a fixed-fixed bridge) until it reaches occlusal contact. Further bending of the pontic during function may take the opposing tooth into supra-occlusion. Laurel suggests regular routine occlusal adjustment on the pontic and or opposing tooth to retain the status quo. This is done at regular six monthly intervals at routine examination. The patient however should be warned at the outset that this will be required together with a longer than normal routine examination, incorporating occlusal adjustment.

OPPOSING DENTITION

Due to tipping of an opposing full upper denture during chewing, distal extension cantilever bridges in the posterior region have greater forces placed upon them and thus the worst opposing dentition is the full upper denture (Lundgren 1991). Owall (1971) showed that over a period of 20 years with distal extension bridges that - although the success rate was in the region of 75% - distal tipping occurred with time, when opposed by a full denture.

CHOICE OF RETAINER

Roberts (1970) has described the poor success rates of the three-quarter crown in fixed-fixed situations. Using two teeth as retainers next to each other will also increase the functional demands on each cement lute and hence the full crown with the ability to achieve greater retention may be the appropriate choice of retainer in this situation. Posts or root-filled teeth have an increased risk of failure in this style of bridgework (Nyman and Lindhe 1979) especially if they are the abutment next to the pontic (terminal end abutment). Alternative bridge designs should then be used possibly including extraction of this root-filled end abutment. This would lead to a reduction in the number of abutments with an increase in the number of pontics. However, Nyman (1979) has shown in his studies on periodontal prostheses that the additional stress on the abutment teeth in this situation is readily accommodated. In the case of non-mobile teeth incorporating an extra pontic into the design will often mean incorporating one extra abutment as well.

CONCLUSIONS

Cantilever bridgework offers an excellent solution for the missing single anterior tooth. The stresses involved in the posterior area however mean that double abutting is often required which brings with it increased demands on the dentist during tooth preparation and further occlusal adjustment during the follow up years.

The next article in this series will concentrate on adhesive bridgework. ■

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