Bridge design, part nine: the 'Periodontal Prosthesis' or Lindhe/Nyman bridge

By Paul Tipton, BDS, MSc, DGDP (UK)

In the latest part of his series on bridgework, Paul Tipton examines an extensive form of bridgework for patients with few remaining teeth

Nyman and Lindhe's work on periodontally terminal dentitions (1979) showed that it is possible to achieve excellent long-term results with extensive fixed-fixed bridgework, even when the abutment teeth are periodontally involved and mobile, if attention is paid to oral hygiene, margin placement, retention and occlusion. In these cases, where there was grade II and III mobility of individual teeth, it was found that the whole of the bridge moved when loading was applied. The increased mobility was regarded as a physiologic adaptation of the periodontal ligament and surrounding bone to the occlusal forces. Nyman (1975) showed that the mobility of the bridgework did not change over a two to six year period, indicating increased but not increasing mobility. This small increased mobility allowed occlusal stresses to dissipate in the periodontal ligament thus placing less strain on the individual cement lutes. Because of this, cementation failure in one or more of the abutment retainers was less frequent than in teeth of normal mobility, as in a healthy dentition.

Over this two to six year period there was a success rate of 94% and the small failure rates were due to cement washout, fracture of the bridge or tooth fracture. In response to this, they changed the designs of their bridges. The height of the various components was increased in the loading direction (crowns, pontics and soldered joints) and retention of individual abutments was increased by preparing grooves and boxes in the tooth abutments and making prepared surfaces of teeth parallel to each other. Cementation could also be better delivered by venting of the bridge allowing better seating. The failures that occurred due to cementation occurred where partial crowns were prepared and fitted as retainers rather than full crowns and their continued use was not recommended.

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Tooth fracture occurred more often on terminal end abutments that were root filled. There is an obvious question mark as to whether these teeth should be used or extracted and additional pontics added onto the bridge.

TYPES OF BRIDGE

Owall (1991) has described twelve unit bridges using two lower canines as the only abutments and has followed these for twenty years showing excellent success rates. He followed eleven patients who had only two remaining natural teeth, vital mandibular canines, who were treated using experimental 12-unit bridges and complete maxillary dentures. After 15 years, seven patients had bridges that were still functional, two had bridge failures, one lost the bridge following oral cancer and one patient died. Nine of the 22 abutments required endodontic treatment.

The lower canines are the last teeth statistically to be lost in the mouth, have excellent bone support, a large periodontal ligament with increased amount of proprioception and are relatively large thus making them ideal bridge abutments for this type of bridge. One of the alternatives is root-filling the canines and turning them into over-denture abutments. This, however, leads to a decrease in their longevity and the longevity of the restoration by increasing the chances of periodontal disease and caries causing their failure. This failure due to caries can be reduced, however, by the daily application of a chlorhexidine and fluoride gel into the recess in the denture (Budtz-Jorgensen, 1995).

MATERIALS

Lindhe and Nyman's work involved using acrylic and gold as the occlusal materials with acrylic also as the veneering material (Figures 1 to 6). Acrylic has a shock absorbance effect during dynamic loading whilst porcelain has a stress reduction effect to the abutments during static loading as with bruxing or clenching (Davis, 1998).

FIGURES 1 TO 6: ACRYLIC BRIDGEWORK

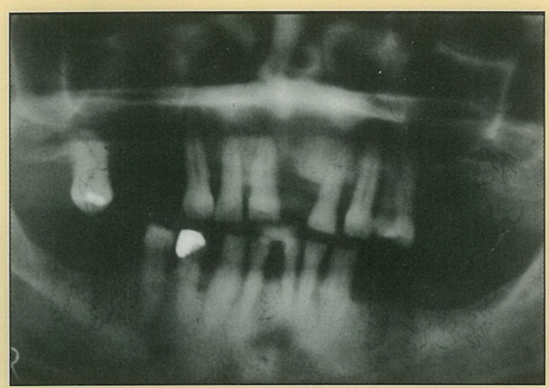

Figure 1: OPG showing tooth loss and periodontal disease

Figure 2: Patient showing advanced periodontal disease

Figure 3: Diagnostic wax up

Figure 4: Left side view of diagnostic wax up

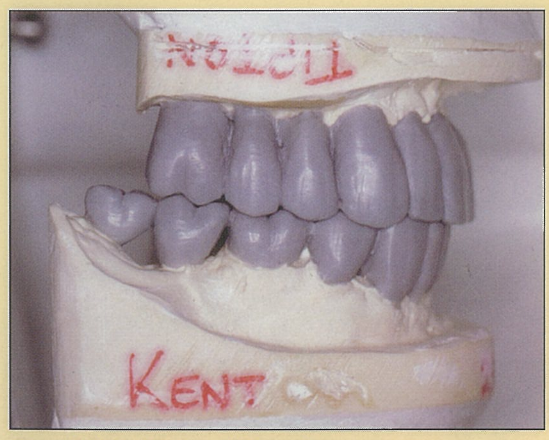

Figure 5: Right side view of diagnostic wax up

Figure 6: Completed fixed acrylic - gold full arch upper and lower periodontal prostheses

Acrylic also rapidly loses its surface characteristics with time leading to loss of occlusal stability and loss of aesthetics. Thus porcelain has also been used for these types of bridges. There are problems with the fit of large full arch porcelain fused to metal bridges as has been described in previous parts of this series. It is more difficult to gain an accurate fit, more technically demanding and so post-ceramic soldering and pick-up impression techniques are required (Figures 7 to 14). Should porcelain fracture it is not as easily reparable as acrylic. For these reasons, when using porcelain as the veneering material for a Lindhe/Nyman bridge, it is advisable to use a coping design or an occlusal splint for night time wear. In circumstances where porcelain fractures it is possible to prepare the bridge to take a crown cemented over the top of the existing bridge. If, however, a coping design has been employed then repair of the porcelain can be completed out of the mouth by the dental technician.

FIGURES 7 TO 14: PORCELAIN FUSED TO METAL BRIDGEWORK

Figure 7: Patient with mobile teeth and advanced bone loss

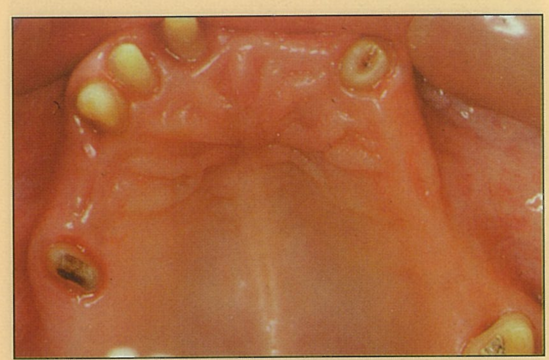

Figure 8: Occlusal view showing tooth preparations

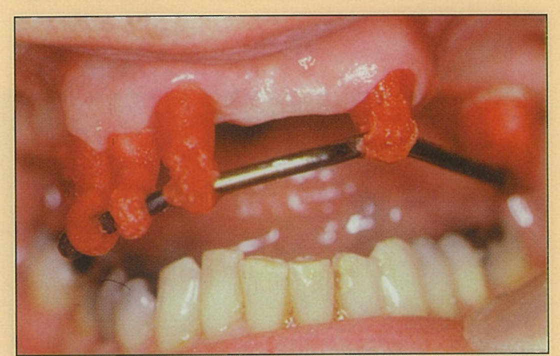

Figure 9: Duralay copings on the preparations joined by coat hanger wire

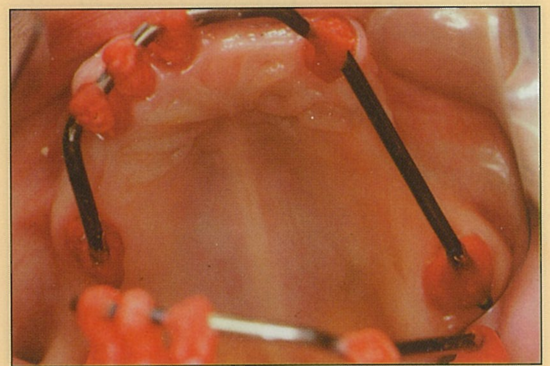

Figure 10: Occlusal view of copings and coat hanger wire

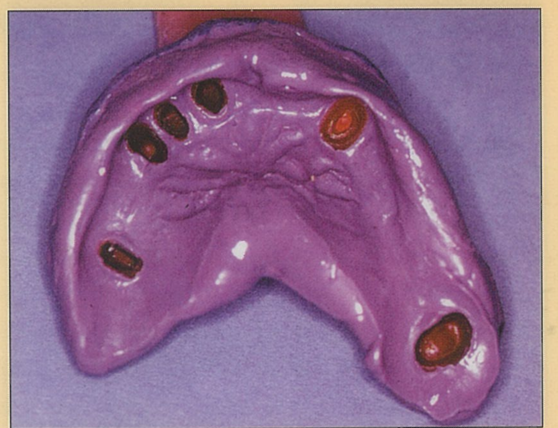

Figure 11: Pick up impressions in Impregum (ESPE)

Figure 12: Bridgework in sections prior to soldering

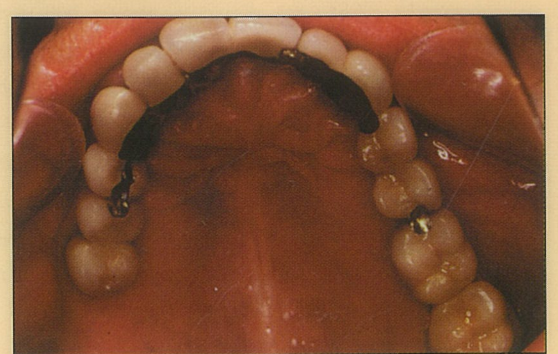

Figure 13: Full arch bridgework soldered - occlusal view

Figure 14: Full arch bridgework soldered - anterior view

OCCLUSAL DESIGN

Permanent stability of the Nyman/Lindhe type of bridgework was achieved by designing the occlusal surface so as to avoid excessive forces on the bridges. Balanced articulation similar to that used for a full denture was preferred to canine or working side disclusion in these fixed

Figure 15: Ten-unit porcelain fused to metal periodontal prosthesis on four mobile abutments

Figure 16: Left side view of abutments and pontics

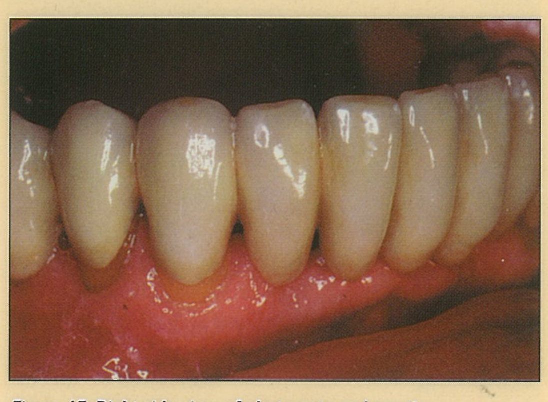

Figure 17: Right side view of abutments and pontics

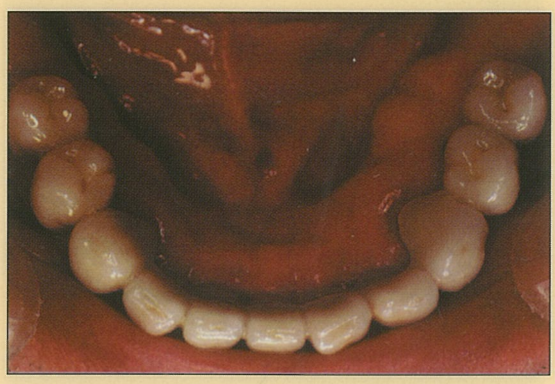

Figure 18: Occlusal view of completed periodontal prosthesis

restorations. Because of the slight mobility of the bridgework, bilateral balance was the optimal occlusal scheme, to prevent occlusal overloading on any one component. It must be remembered however that Lindhe & Nyman were periodontists who completed these full mouth reconstructions and not prosthodontists.

In those cases where the intercuspal position (ICP) was not coincident with the retruded contact position (RCP), then Lindhe and Nyman recommended that the slide between the two was also in bilateral balance. However, Wise (1995) recommends restoring the patient who requires a full mouth reconstruction with a reorganised approach. In this way the condyles are placed in their most superior anterior position in the fossa (RAP) with no slide present between RCP and ICP.

CANTILEVER DESIGN

In cases with no posterior abutments (and therefore the risk of forward migration of the entire bridge during function) pontics were cantilevered distally to achieve a positive ICP with the opposing teeth, thus establishing a stable occlusion. Thus, when chewing on the anterior teeth and experiencing anterior migration, swallowing the bolus of food is followed by a re-established intercuspal position (due to tooth contacts) and due to these positive contacts on the distal cantilevered units the bridge is brought back into its correct position. Anterior migration is therefore limited and does not continue. In one instance up to six pontics were cantilevered around the arch from the last standing abutment. In this particular case the only remaining abutments were $\overline{5431|}$ with a bridge placed on from fist molar one side to the first molar the other side of 12 units!

Lundgren (1986) has previously shown that distal cantilever units are on average subjected to forces less than half of those over end-abutment bridges. Furthermore, the cantilever forces either equalled or were significantly smaller than these over the anterior regions. He concluded that periodontal tissues can withstand transient occlusal forces which are much larger than those generally operating during chewing, swallowing and biting with maximal strength in habitual occlusion.

OPPOSING DENTITION

Schwartz (1970) showed that the best opposing dentition for conventional bridgework (with no distal extension cantilever units) was the full denture. Lundgren (1991) has showed that in the case of the distal extension cantilever bridge the full denture is the worst opposing dentition for success. He showed that with cantilevers in the lower jaw opposing a full upper denture, the patient functions and chews anteriorly. This leads to anterior ridge resorption (Combination Syndrome) and posterior tilting of the denture. This in turn places excess forces on the distal cantilevered units causing an increased failure rate. Owall (1991) when reviewing his experience with 12-unit bridges on two canines over 20 years showed that after 12-15 years, the bridges often started to tilt distally, presumably because they were opposed by full dentures and these dentures unseat posteriorly during function placing excessive forces on the distal cantilevers.

Therefore, when opposing a full upper denture this style of bridge is often placed on copings (Robertson 1985) so that excess stress is transmitted to the soft cement lutes (which act as a stress breaker in this instance) or the distal cantilever units are placed out of occlusion (Figures 15 to 18).

CONCLUSIONS

Although these particular bridges may be regarded as extreme in relation to the minimal amount of periodontal support, the results clearly show that after proper periodontal treatment in patients with high standards of oral hygiene, it is possible to achieve permanent bridge stability and prevent further loss of attachment provided attention is paid to retention and occlusion.

Once the bridges were inserted the oral hygiene included three monthly visits with the hygienist which is practical in general practice.

Therefore, contrary to the opinions of Smith (1961) and Reynolds (1968), severe reduction of periodontal support around isolated abutments does not seem to contraindicate fixed bridgework.

The next article in this series will concentrate on removable implant supported bridgework. ■

ACKNOWLEDGEMENTS

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Last month's article featured an incorrect caption. It should have read: Figure 8: Final bridgework cemented with temporary cement