Bridge design, part one: causes of bridge failure

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In the first of a ten-part series, Paul Tipton looks at the evolution of bridge design and examines the reasons for bridge failure.

A recent paper in the *British Dental Journal* (Ibbetson, 1999) highlighted the variations in treatment planning and bridge designs by 55 dentists attending a continuing education course. 70% of respondents chose to reuse abutment teeth which were extensively damaged and had failed to retain the previous bridge. A further 70% chose to use multiple abutments to support the bridgework which, in light of more recent work, appears an outdated concept. How then has bridge design evolved? It is the aim of this paper to discuss the causes of bridge failure.

As long ago as 1926 Ante proposed his law that 'the total periodontal membrane area of abutment teeth should equal or surpass that of the teeth to be replaced'. He postulated that teeth with loss of their supporting structure due to periodontal disease cannot be successfully used as abutments for fixed prosthetic reconstructions. This principle has since been reinforced in the literature (Tylman, 1965; Johnston, 1971; Shillingburg, 1981). However, there is evidence that teeth with very poor periodontal support can serve successfully as fixed bridge abutments in carefully selected cases. Ante proposed his law at a time when periodontal disease and its causes were partly understood and occlusion was based on the concepts of bilateral balance from complete denture prosthetics.

Teeth with severe bone loss and marked mobility have been used as bridge and splint abutments (Nyman and Lindhe, 1976). The goal in such cases is not elimination of mobility but rather the stabilisation of the teeth to prevent an increase in mobility (Nyman et al, 1975). In these situations abutment teeth can be maintained free of inflammation, despite their mobility, if certain criteria are met and patients are well motivated and highly proficient in plaque removal. Follow-up studies of these patients with 'terminal dentitions' indicate a low failure rate. Less than 8% of 74 bridges exhibited technical failure in a time span that averaged more than six years (Nyman and Lindhe, 1979). Why, then, do bridges fail?

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Figure 1: Caries around bridge retainers

FIGURE 2:
THE CAUSES OF BRIDGE FAILURE

Caries - 37%	Periodontal Disease - 7%
Uncemented crowns - 12 %	Occlusal trauma - 3%
Defective margins - 11%	Mobility - 1.5%
Wear - 7.5%	

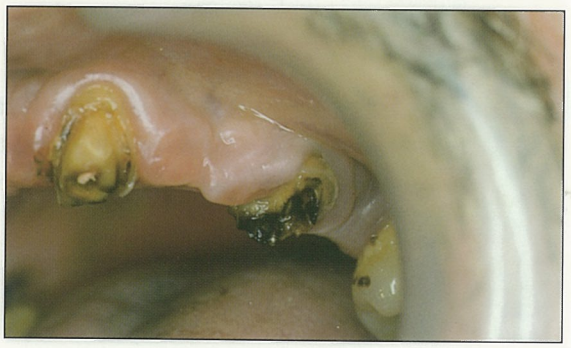

Figure 3: Bridge failure due to cementation failure

CAUSES OF BRIDGE FAILURE

Morrant (1956) reviewed bridges made at the Eastman Dental Hospital over a two-year period. He found that most bridges failed because of loss of mechanical retention long before periodontal problems arose. He also noted that the greatest failure rate was with bridges of a fixed-fixed design. Roberts (1970) reviewed 1046 bridges constructed by staff and students at the Eastman Dental Hospital between 1952 and 1964.

He found the greatest failure rate was due to caries (Figure 1) and not periodontal deterioration, due to overloading of