Cantilever fixed prostheses utilizing dental implants:  
A 10-year retrospective analysis

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Objective: The dental literature has been unclear about long-term success of fixed cantilever prostheses supported by dental implants. The disappointing results reported when cantilever fixed partial dentures (FPDs) are supported with natural teeth are not directly applicable to implant cantilever FPDs. This article reports on 10 years of implant-retained fixed prostheses primarily in the maxillary arch using the ITI dental implant system. Method and materials: Sixty cantilever prostheses using 115 ITI dental implants on 36 patients were placed and monitored over a 10-year period. Results: No implant fractures, abutment fractures, porcelain fractures, prosthesis fractures, soft tissue recession, or radiographic bone loss were recorded. All 60 cantilevered prostheses remain in satisfactory function. Conclusion: Positive, long-term results, using implant-retained cantilever FPDs can be achieved by: (1) using a rough surface implant of 4.1 mm or greater; (2) using an implant/abutment design that reduces stacked moving parts and reduces the implant-to-crowns ratio; and (3) using a cementable prosthesis design that eliminates the need for occlusal screw retention. (Quintessence Int 2004;35:437–441)

Key words: cantilever prosthesis, implant, osseointegration

CLINICAL RELEVANCE: Implant-retained cantilever fixed partial dentures can be an adjunct to tooth replacement and can provide treatment alternatives for compromised situations.

Cantilever fixed partial dentures (FPDs) utilizing natural tooth abutments have a reported poor prognosis ranging from 36% failure to 40% failure in 5 to 7 years. Cross-arch stabilization can improve the long-term prognosis to single-digit failure rates over 5 to 8 years but prosthetic difficulties and stringent periodontal prerequisites/maintenance have rendered the cantilever FPD using natural teeth as abutments risky, technically difficult, and unpredictable for periodontal and restorative dentists.

Early implant-retained prosthesis utilized cantilevers via a bar/clip removable prosthesis or a screw-retained "hybrid" or "fixed/removable" prosthesis. These implant-retained cantilever prostheses proved to be more reliable than cantilever FPDs using natural tooth abutments particularly when utilized in the mandible. These early implant-retained prostheses all utilized cross-arch stabilizing designs with fixed (screw-retained) splinting of the dental implants. Complications of implant-retained fixed and removable prostheses have been reported. These complications/failures were primarily reported on machine surface, external hex, and 3.75-mm diameter implants. These failures centered around abutment screw loosening/fracture, occlusal screw loosening/fracture, implant fracture, prostheses fracture and crestal bone loss. There seems to be no consensus as to whether crestal bone loss occurs prior to implant fracture or whether implant fracture causes bone loss. A higher incidence of implant fracture has been reported in fixed partial dentures supported by only two implants. As a result of these disappointing reports, few restorative dentists have been willing to recommend FPD cantilever prostheses for their implant patients, particularly in the posterior maxilla.
Perceived objections to FPD implant-retained cantilever prostheses may be unfounded with the advent of technological improvements to implant components and design: (1) Roughened surfaces to dental implants increases bone apposition, strength, and retention; and (2) wider-diameter implants (4.1 mm or greater) have eliminated implant fracture. While wide-platform machine surface implants have shown a higher failure rate, this has not been the experience with a rough surface implant design; elimination of stacked components and microgaps can reduce prostheses/abutment movement and improve the crown-to-implant ratio; (4) cemented components eliminate fracture or loosening of occlusal screws and eliminates the controversy over "static loading" or "misfit" (passive fit).

This article will report on 10 years experience in a private practice setting, using the clinical considerations proposed by Becker and Kaiser for implant-retained cantilever FPDs.

METHOD AND MATERIALS

Between May 1993 and May 2003, 60 cantilever FPD restorations were placed on 35 patients (18 women and 17 men) from the ages of 33 to 73 years (Fig 1). All FPDs were placed on ITI (Institut Straumann AG) rough-surface implants. There were 115 implant abutments: 76 at 4.1-mm transosseous diameter and 39 at 4.8-mm transosseous diameter including 6 wide-neck implants (4.8-mm transosseous diameter and 6.5-mm occlusal platform). Twelve of the implants were placed immediately after extraction of the tooth, and 105 implants were placed with a delayed healing approach. Three prostheses were screw retained (all in the maxillary arch), and 57 were cemented with zinc oxyphosphate cement (Fleck's, Mizzy). There were 30 two-abutment one-cantilever FPDs (Fig 2), 19 three-abutment one-cantilever FPDs (Fig 3), 10 two-abutment two-cantilever FPDs (Fig 4), and 1 one-abutment one-cantilever FPD (Fig 5). Six FPDs were in the mandible, all cantilevering premolars. Fifty-four FPDs were in the maxilla: 20 replacing molars; 26 replacing lateral incisors; 6 replacing premolars; and 2 replacing cuspids.

RESULTS

Over the 10-year period, one screw became loosened, and two prostheses needed to be recemented, both within 1 month of initial placement. This suggests operator error in the initial cementation. There occurred no framework fracture; porcelain fracture (there were two incidents of minor porcelain chipping, which was handled by smoothing the effected area with a polishing wheel); implant fracture; abutment fracture; occlusal screw fracture; soft tissue recession in the esthetic zone; or radiographic evidence of bone loss. There was complete patient satisfaction for all patients for the entire duration of the study.

DISCUSSION

Implant-retained cantilever FPDs provide restorative and surgical implant clinicians with some unique and needed treatment options. By using cantilevers, fewer implants are needed, which reduces cost. Implant-retained fixed prostheses can be considered in risky areas by avoiding implants to sinus areas or other minimal bone sites. Parallel problems for the surgeon can...
Fig 2a  Typical posterior cantilever FPD utilizing two implants.

Fig 2b  Implants with 4.0-mm solid abutments for patient in Fig 2a.

Fig 2c  Radiograph of implant-retained fixed cantilever prostheses for patient in Fig 2a. Implants had been in place for 4 years.

Fig 3a  Typical posterior cantilever FPD utilizing three implants.

Fig 3b  Implants with 5.5-mm solid abutments for patient in Fig 3a.

Fig 3c  Radiograph of implant-retained fixed cantilever prostheses for patient in Fig 3a. Implants had been in place for 4 years.

Fig 4a  Typical anterior cantilever FPD with two pontics (maxillary right and left laterals) utilizing two implants in the right and left central position.

Fig 4b  Implants with 5.5-mm abutments in place for patient in Fig 4a.

Fig 4c  Panorex radiograph of implant-retained anterior and posterior fixed cantilever prostheses for patient in Fig 4a. Implants had been in place for 3 years.

Fig 5  Ten-year radiographic comparison of a single-implant cantilever FPD.
be reduced by keeping fixed prostheses to three or fewer implants. When two implants are needed for a three-unit FPD, the surgeon has the discretion to choose the two sites with the best bone and have confidence that the prostheses will be successful regardless of the pontic location. The size of the implant diameter was not shown to be a factor in long-term success as long as it was 4.1 mm or wider. Six of the patients were smokers, but this had no adverse effect on outcome of osseointegration or the longevity of the prostheses, which is consistent with the findings of Kumar et al., when using rough-surface implants. Immediate placement of implants into fresh extraction sites did not affect the outcome of cantilever prosthesis longevity, which is consistent with the results of other immediate implant studies.

CONCLUSION

Positive long-term results, using implant-retained cantilever FPDs, can be achieved by: (1) using a rough-surface implant of 4.1-mm or greater diameter; (2) using an implant/abutment design that reduces stacked moving parts and reduces the implant-to-crowns ratio; and (3) using a cementable prosthesis design that eliminates the need for occlusal screw retention.

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