Complication and Failure Rates of Tooth-Supported Fixed Dental Prostheses After 7 to 19 Years in Function

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Purpose: The aims of this study were to reexamine patients who had received fixed dental prostheses (FDPs) more than 10 years prior, list the frequencies of observed technical and biologic failures and complications, and calculate the estimated failure and complication rates at 10 and 15 years. ***Materials and Methods:*** Fifty-six of 195 patients who were treated by undergraduate students during their state board examinations in fixed prosthodontics between 1990 and 1999 at the School of Dental Medicine, University of Bern, Bern, Switzerland, were recalled successfully. ***Results:*** At reexamination, it was determined that 56 patients with a mean age of 62 years (range: 41 to 85 years) had received 95 metal-ceramic FDPs supported by 202 abutment teeth. Prostheses had been in function for 7 to 19 years (mean: 14 years). The FDPs demonstrated a high estimated survival rate of 90.4% after 10 years and 80.5% after 15 years, although 17 of the 202 abutment teeth had been lost. The probability to remain free from any complication/failure was 79.7% at 10 years and 34.6% at 15 years. The risk of FDPs being affected by a biologic complication or failure after 10 years was 14.9%; the risk was 5.34% for a technical complication or failure. After 15 years, the risks of a biologic or technical complication or failure were 45.7% and 19.7%, respectively. ***Conclusions:*** The survival rates of FDPs decreased gradually with time. Freedom from complications and failures was drastically decreased for FDPs that had been in function for longer than 10 years. *Int J Prosthodont 2012;25:360–367.*

The incorporation of fixed dental prostheses (FDPs) is only justified if, compared to the gain in comfort and quality of life, success and survival rates lie within acceptable limits. For instance, in young adult patients requiring FDPs for the replacement of missing teeth resulting from birth defects (cleft lip, alveolus, and palate; agenesis), the reconstructions are expected to last for decades, preferably with low rates of maintenance service and additional financial consequences.[1,2] In that patient cohort, 73% of FDPs on teeth remained complication free over a mean observation period of 16 years. Moreover, when older patients treated for chronic periodontitis received FDPs on teeth and remained in a periodontal supportive care program, the risk of losing an FDP at 10 years was only 3%.[3]

In several systematic reviews in which data from clinical long-term studies were pooled and analyzed, metal-ceramic FDPs demonstrated high estimated cumulative survival and success rates at 5 and 10 years.[4] The estimated success rate of metal-ceramic FDPs after 5 years was 84.3% (range: 72.3% to 91.5%).[4] Success of a reconstruction was defined as an FDP that remained unchanged and free from complication over the entire observation period. Survival was defined as a reconstruction remaining in situ with or without modification over the observation period. The estimated survival rate amounted to 93.8% (range: 87.9% to 96.6%) after 5 years and 89.2% (range: 76.1% to 95.3%) after 10 years.[4]

Some conditions, such as the presence of endodontically treated abutment teeth, cast posts and cores, and extension cantilevers, can result in increased failure and complication rates.[3,5,6]

Few studies have reported on tooth-supported FDPs documented for 10 years or longer.[7–13] In general, these studies showed increased failure rates with prolonged time in function. Survival rates ranging between 46% and 70% after 20 years were reported.

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In recent decades, treatment planning for fixed reconstructions has been broadened by the options of implant-supported single crowns or implant-supported FDPs. Comparing patient cohorts that had been provided with crowns and FDPs before and after the introduction of implants into dentistry, an increased preference for shorter reconstructions and more patients being treated with single crowns on implants has been documented.[14,15]

In addition to the new options with implant-supported reconstructions, progress in material science and computer-assisted processing has led to the preference for computer-aided design/computer-assisted manufacture of frameworks and complete ceramic reconstructions, ie, zircona frameworks. Nevertheless, the metal-ceramic FDP remains a standard treatment option in reconstructive dentistry. Hence, success and survival rates for metal-ceramic FDPs may be regarded as the gold standard for comparison of treatment outcomes achieved with single crowns on implants, such as FDPs on implants or all-ceramic FDPs.

The aims of this retrospective study were to reexamine clinically patients who had received FDPs more than 10 years prior and to calculate, based on the observed number of complications and failures, the estimated failure and complication rates per 100 reconstructions at 10 and 15 years. Potential risk factors related to the patients and the design of the FDPs were associated with failure and success rates.

Materials and Methods

The charts of all patients who had participated in the comprehensive undergraduate clinic course and had received at least one FDP as part of the Swiss State Board Examination in the years 1990 to 1999 were screened by two of the authors.

The partially edentulous patients had been treated in the undergraduate clinic under the supervision of the staff of the Department of Periodontology and Fixed Prosthodontics, University of Bern, Bern, Switzerland, and were treated according to a comprehensive care concept. Following this, all patients received one FDP as part of the requirements for the students to pass their state board examinations. Some patients had already received one or more additional FDPs during the preceding semester. Patients were contacted in 2009 by two of the authors and asked to participate in a clinical reexamination of their reconstructions. Patients also were offered to participate in the next student course if any problems with the existing FDP should be diagnosed.

Of 195 listed patients, 88 could be reached; 99 patients could not be located or did not respond to the invitation. Eight patients had passed away. From the 88 patients contacted by phone, 32 were not interested in a follow-up examination. Finally, 56 patients (32 women, 24 men) with 95 FDPs accepted the invitation to be reexamined in 2009.

All reconstructions were metal-ceramic FDPs. In the posterior region, the preparation margins had been placed supragingivally, and in the anterior region, crown margins had been placed slightly below the gingival margin for esthetic reasons. Every abutment was prepared according to the standard concept of the clinic, requiring a chamfer with a bevel or, in the esthetic region, a porcelain butt margin. After preparation of the abutment teeth, an impression was taken using polyether material (Impregum, 3M ESPE). Retraction cords had been placed carefully into the sulcus prior to the impression procedure. Provisional FDPs were fabricated in acrylic resin (Unifast, GC) and cemented using temporary cement (TempBond, Kerr). In cases of severe loss of the dentin core substance, a cast post and core was fabricated on root canal–treated teeth. A standard ferrule of 2 mm was a prerequisite. If not feasible, surgical crown lengthening was performed.[16] Twelve different technicians were involved in the fabrication of the FDPs. Endodontic treatments were done under the supervision of the Department of Preventive, Restorative, and Pediatric Dentistry, University of Bern. All cast posts and cores were made separately from the retainer. The majority of the reconstructions and cast posts and cores were cemented using zinc phosphate cement (De Trey, Dentsply).

At the reexamination, patients first filled out a questionnaire regarding their satisfaction with the reconstructions, their oral hygiene and smoking habits, their experiences with the reconstructions, and the frequency of recall sessions observed over the past years.

The clinical examination comprised the enumeration of the presence or absence of teeth, the type of reconstructions (conventional or cantilever extension FDP), and the location and number of units replaced per reconstruction. The probing pocket depths (PPDs) and gingival recessions in relation to the cementoenamel junction were measured at six aspects of each abutment tooth to calculate the level of clinical attachment. Bleeding on probing (BoP) and the Plaque Index values were recorded at four sites per abutment tooth. Tooth mobility and furcation involvement of multirooted teeth were assessed.[17,18] Abutments were tested for vitality by means of the carbon dioxide test, and the presence of caries lesions was noted. Occlusal analysis included contacts in centric occlusion, contacts in lateral articulation movement,

Table 1 Mean Observation Period of FDPs and Abutment Teeth

	No. of FDPs	No. of abutment teeth	Observation period (y)		
			Mean	Minimum	Maximum
Conventional FDP	76	156	14.31	7.12	19.11
CFDP	19	46	12.23	10.39	14.39
Total	95	202	13.89	7.12	19.11

Conventional FDP = end abutment teeth; CFDP = cantilever extension FDP on tooth abutments.

attrition, presence of a shortened dental arch, overjet, overbite, and bruxism. Reconstructions were carefully examined for any technical complications.

Radiographic examination included periapical intraoral radiographs from the crowned teeth.

Assessment of biologic complications included the presence or absence of secondary caries at crowned teeth, root caries at crowned teeth, vitality, need of endodontic treatment, periapical endodontic lesions, tooth mobility, root resorption, root fracture, abutment fracture, and periodontitis (defined as positive BoP and PPD ≥ 6 mm).

Assessment of technical complications included the presence or absence of retention, ceramic chipping, fracture of the framework, and marginal misfit. The loss of teeth or reconstructions as well as damage to the fixed reconstructions because of trauma were noted based on incidences reported in the questionnaire and as noted in the patients' charts.

A successful reconstruction was defined as a reconstruction with no failure or complications reported or detected during the observation period. A surviving reconstruction was defined as an original reconstruction still in situ, with complications being treatable. Failure was defined as a biologic, technical, or traumatic event leading to either extraction of an abutment tooth or loss of the original FDP.

Statistical Analysis

Descriptive statistics listed the number of reconstructions incorporated as well as the number of reconstructions with complications and failures observed over 10 and 15 years.

For an event of interest, time-to-event analysis was performed by calculating the Kaplan-Meier survival function.[19] The cumulative risk after 10 and 15 years of observation was calculated by subtracting the Kaplan-Meier survival function from 1. Cumulative risk was calculated for complications and failures (biologic and technical). Poisson regression was used to compare the two categories of FDPs (conventional or cantilever extension) and different values of covariables (eg, number of replaced units per abutment, sex, smoking, interdental cleaning, regular maintenance) with respect to the incidence rate of failures and complications by calculating rate ratios over the entire observation period. More than one reconstruction was included in the analysis for some patients. This correlation was accounted for by calculating robust standard errors in the Poisson regressions.

For event rates and incidence rate ratios, estimates and 95% confidence intervals (CIs) were reported based on the assumption that the number of events is Poisson distributed for a given observation period. Reported *P* values were two-sided. For the cumulative incidence, 95% CIs were reported based on those obtained from the Kaplan-Meier estimate. All analyses were completed using Stata version 11 (Stata Corporation).

Results

In total, 56 patients were reexamined (32 women, 24 men). At the time of reexamination, the mean age was 62 years (range: 41 to 85 years), and the FDPs had been in function for over 7 and under 20 years (mean: 14 years) (Table 1).

Reconstruction Location and Number of Units

All 95 original reconstructions were metal-ceramic FDPs. Of the 56 patients, 21 contributed 2 FPDs, 6 contributed 3 FPDs, and 2 contributed 4 FPDs. The remaining 27 patients received only 1 FDP. Seventy-six FDPs were conventional reconstructions with end abutments and 19 were cantilever extension FDPs. Of the 19 cantilever extension FDPs, 1 had 3 extensions, 2 had 2 extensions, and 16 had only 1 extension (Table 1).

Figure 1 demonstrates the distribution of FDPs based on exposure time. Only two FDPs had been functioning less than 10 years; the other FDPs had been placed between 11 and 20 years prior.

The median number of units per reconstruction was 4 (range: 3 to 10); 34 (35.8%) reconstructions had 3 elements, 43 (45.3%) had 4, 14 (14.8%) had 5, 2 (2%) had 6, 1 (1%) comprised 9 units, and 1 (1%) had 10 units (Table 2).

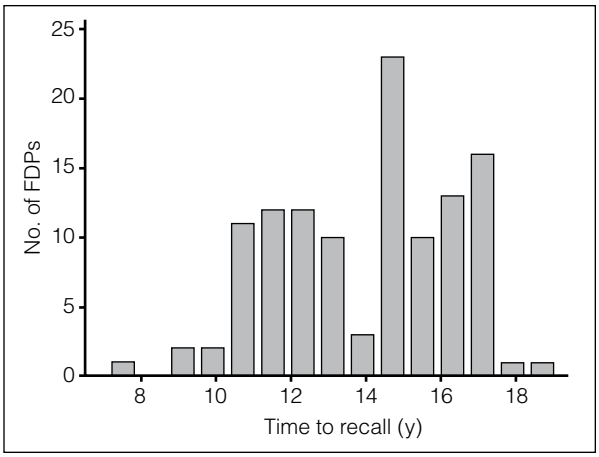

Fig 1 Distribution of FDPs based on exposure time.

Table 2 No. of Elements per FDP

No. of elements	Frequency	Percent	Cumulative (%)
3	34	35.79	35.79
4	43	45.26	81.05
5	14	14.74	95.79
6	2	2.11	97.90
9	1	1.05	98.95
10	1	1.05	100.00
Total	95	100.00	

Table 3 Location of FDPs per Sextant

Sextant*	Frequency	Percent	Cumulative (%)
1	11	11.58	11.58
1 and 2	8	8.42	20.00
1, 2, and 3	1	1.05	21.05
2	8	8.42	29.47
2 and 3	17	17.89	47.36
3	13	13.68	61.04
4	14	14.74	75.78
4 and 5	3	3.16	78.94
5	3	3.16	82.10
5 and 6	3	3.16	85.26
6	14	14.74	100.00
Total	95	100.00	

*Sextant 1 = maxillary right second molar to first premolar; sextant 2 = maxillary right canine to left canine; sextant 3 = maxillary left first premolar to second molar; sextant 4 = mandibular left second molar to first premolar; sextant 5 = mandibular left canine to right canine; sextant 6 = mandibular right first premolar to second molar.

Table 4 PPD Values Measured at Reevaluation*

PPD (mm)	Frequency	Percent	Cumulative (%)
1	72	5.94	5.94
2	453	37.38	43.32
3	348	28.71	72.03
4	104	8.58	80.61
5	51	4.21	84.82
6	20	1.65	86.47
7	8	0.66	87.13
8	1	0.08	87.21
Undefined	155	12.79	100.00
Total	1,212	100.00	

PPD = probing pocket depth.
*Values taken from six aspects of each tooth measured.

The locations of the reconstructions are listed by sextant in Table 3. Fifty-eight FDPs were located in the maxilla (sextants 1 to 3) and 37 FDPs were in the mandible (sextants 4 to 6).

At the follow-up examination, 81 reconstructions were still in function. After 10 and 15 years, the estimated success rates were 79.8% and 34.6%, respectively. This, in turn, means that these reconstructions never had any problems nor did they need retreatment. The estimated survival rates after 10 and 15 years were 90.4% and 80.5%, respectively.

Abutment Teeth

The 95 reconstructions were supported by 202 abutment teeth (Table 1). One hundred thirty-five abutment teeth had been vital at the time of cementation, and 67 had received root canal treatment. Forty-three abutment teeth had received a cast post and core, while 17 received a composite resin buildup, 1 with a metal post and 16 with a screw post. The remaining abutments had neither a post nor a screw. Seventeen abutment teeth were missing at the time of reexamination.

Clinical Parameters at Reevaluation

Plaque was found at 29.1% of surfaces of the abutment teeth, and 20.2% of these sites were positive for BoP. The mean PPD was 2.7 mm, with a range of 1 to 8 mm, whereas the mean recession per tooth was 0.5 mm. The mean clinical attachment level was at 3.3 mm from the margins of the reconstructions.

Table 5 No. of FDPs with Technical Complications Over the Observation Period

	No. of FDPs
Loss of retention	3
Fracture of framework	7
Insufficient margin fit	2
Total	12

Table 6 Estimated Risk of Biologic and Technical Complications After 15 Years

Type of complication	Estimated risk	95% CI
Dental caries	0.148	0.075–0.282
Periodontitis	0.142	0.076–0.258
Root canal treatment	0.113	0.059–0.212
Material fracture	0.074	0.030–0.177

CI = confidence interval.

Table 7 No. of Failures Over the Observation Period

Reason for failure	No. of reconstructions	Year
Caries	3	10, 15, 15
Endodontic problems	2	2, 4
Apical periodontitis	2	10, 17
Fracture of abutment	1	7
Loss of retention	2	5, 15
Fracture of framework	1	2
Other	3	1, 5, 11
Total	14	

Table 8 Estimated Risk of Biologic and Technical Failures After 15 Years

Type of failure*	Estimated risk	95% CI
Biologic	0.115	0.057–0.225
Technical	0.079	0.027–0.216

CI = confidence interval.
*Biologic failures include caries, endodontic treatment after cementation, loss of vitality, apical periodontitis, mobility, periodontitis, and root amputation; technical failures include loss of retention, fracture of framework, and marginal misfit.

The frequency distributions of the clinical parameters are listed in Table 4. The majority (ie, 84.8%) of all abutments yielded a PPD ≤ 5 mm.

Biologic and Technical Complications Observed

Complications at Reexamination. At the time of the clinical examination, 36 FDPs (7 cantilever extension and 29 conventional reconstructions with end abutments) had developed at least one biologic complication. Technical complications had occurred in 12 of 95 FDPs; 1 was seen in a cantilever FDP and 11 in conventional FDPs. Loss of retention had occurred in 3 reconstructions, 7 demonstrated chipping of porcelain, and 2 reconstructions recorded marginal misfit (Table 5).

Complications After 15 Years. The estimated cumulative risks of biologic and technical complications were 41.5% (95% CI: 30.8% to 54.2%) and 12.6% (95% CI: 6.58% to 23.4%), respectively, at a mean 15 years in function. The most frequent complications (calculated for 100 FDPs) were dental caries (14.8%, 95% CI: 7.47% to 28.2%), periodontitis (14.2%, 95% CI: 7.55% to 25.8%), loss of vitality (11.3%, 95% CI: 5.84% to 21.2%), and material fracture (7.43%, 95% CI: 3.02% to 17.7%) after 15 years (Table 6).

Biologic and Technical Failures Observed

Failures Observed at Reexamination. Of the 14 reconstructions lost over the observation period, 10 were a result of biologic problems and 4 were due to technical reasons. Caries was responsible in 3 cases, 2 cases suffered endodontic failure, 2 had apical periodontitis, and 1 suffered a fracture of the abutment. Loss of retention was noted in 2 instances, and fracture of the framework was responsible for the technical failure of 1 reconstruction. Trauma, pain, and other factors resulted in 3 additional losses of FDPs (Table 7).

The abutment teeth were kept in place for a new FDP in two cases, whereas the abutments were replaced by implants now supporting FDPs or single crowns in seven reconstructions. In the remaining five cases, at least one abutment was lost but another could be used as an abutment for a new reconstruction, such as a single crown or FDP.

Failures After 15 Years. The estimated cumulative risks of failure because of biologic or technical problems were 11.5% (95% CI: 5.74% to 22.5%) and 7.9% (95% CI: 2.73% to 21.6%) after 15 years (Table 8).

Biologic and Technical Complications or Failures After 10 and 15 Years (No Success)

After a mean 10 years in service, the estimated cumulative risks for the FDPs to show biologic or technical complications or failure were 14.9% (95% CI: 9.1% to 23.9%) and 5.3% (95% CI: 2.3% to 12.4%), respectively. The main reasons for complications included dental caries (1.1%, 95% CI: 0.2% to 7.6%), root canal treatment (9.6%, 95% CI: 5.1% to 17.6%), and material fracture (3.2%, 95% CI: 1.0% to 9.6%).

Table 9 Estimated Risk of Biologic and Technical Complications or Failures After 10 and 15 Years

Type of failure or complication	Estimated risk at 10 y	95% CI	Estimated risk at 15 y	95% CI
Biologic complication or failure	0.149	0.091–0.239	0.457	0.352–0.578
Dental caries	0.011	0.002–0.076	0.194	0.109–0.334
Endodontic treatment	0.096	0.051–0.176	0.134	0.074–0.234
Technical complication or failure	0.053	0.023–0.124	0.197	0.114–0.327
Material fracture	0.032	0.010–0.096	0.115	0.052–0.241

CI = confidence interval.

After a mean 15 years in function, the estimated cumulative risks for the FDPs to show biologic or technical complications or failure were 45.7% (95% CI: 35.2% to 57.8%) and 19.7% (95% CI: 11.4% to 32.7%), respectively. The main reasons for these complications included dental caries (19.4%, 95% CI: 10.9% to 33.4%), root canal treatment (13.4%, 95% CI: 7.4% to 23.4%), and material fracture (11.5%, 95% CI: 5.2% to 24.1%) (Table 9).

Factors Related to Patients and FDPs

A tendency for more complications or failures was observed in smokers and patients neglecting interdental cleaning and not complying with regular maintenance. However, none of the factors related to the patients or the design of the FDP were statistically significantly associated with technical or biologic complications or failures.

Discussion

The 56 patients reexamined in this study had been treated during the undergraduate comprehensive care course at the School of Dental Medicine, University of Bern. At the end of the corrective phase, one or more metal-ceramic FDPs had been incorporated on abutment teeth.

After the comprehensive care course at the university, most patients had been referred to private practices for maintenance.

After 10 years, the estimated risk of biologic complication or failure was 14.9%; the risk of technical complication or failure was 5.34%. After 15 years, the risk to show biologic complication or failure was 45.7%; the risk of technical complication or failure was 19.7%. Most patients seemed to maintain their abutment teeth in a relatively healthy periodontal status, as documented by mean plaque and bleeding indices reflecting a moderate level of hygiene.

Glantz et al[7] showed that in the majority of reports on long-term outcomes with FDPs, clear methodologic disadvantages existed. Patient groups were either not randomized or were treated by dental students in undergraduate programs. In addition, there was a lack of information on patient control, ie, periodontal supportive therapy, high dropout rates, etc. However, De Backer et al[13] noted that the survival of FDPs provided by undergraduate students at a university clinic was comparable to the results published by staff members of university departments or general practitioners. In that retrospective study, a mean survival rate of 66.2% was noted for FDPs provided by undergraduate students.[13]

The findings of this report correspond to the results of similar studies on the long-term clinical performance of tooth-supported FDPs. Figure 2 shows the estimated survival rates at 10 and 15 years from the present study plotted together with data obtained from eight other studies providing survival rates of FDPs at 5 to 30 years. In general, an almost linear gradual decrease in the survival rates is evident.

Long-term survival rates of FDPs provided by clinicians in private practice or public institutions were mainly published by Swedish authors. In the report by Glantz et al,[7] a group of patients was located through the Swedish National Dental Insurance program. One dentist contributed one FDP to the study. After 22 years, the survival rates were 46.5% for crowns and 41.1% for pontics. A considerable decrease in the quality of the reconstructions over the more than 20-year observation period was noted. The California Dental Association quality ratings of crowns demonstrated that a poor baseline quality was a strong predictor for reduced survival time. Extension cantilever FDPs, especially those with a distal cantilever, showed an increased risk of failure ($P = .05$).

In a report by Eriksson et al,[8] the main focus was to document the impression technique with hydrocolloid alginate, which resulted in satisfying outcomes for FDPs. One hundred fifty-one women and 104 men, who were on average 55 and 54 years old, respectively, were examined. Collectively, 1,271 tooth units were replaced with 911 abutment teeth. A total of 469 FDPs were built with 6 to 14 units, 541 FDPs were 2 to 5 units, and 261 were single crowns. The crowns and FDPs constructed based on working casts produced with alginate impressions demonstrated survival

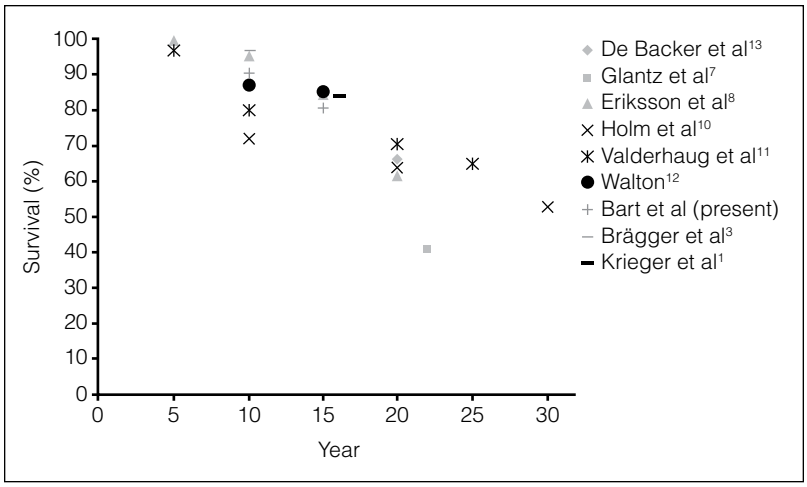

Fig 2 Survival rates of FDPs on teeth over 5 to 30 years, as reported in nine studies.

rates similar to reconstructions fabricated based on silicone or polyether impression materials. Crown and FDP survival rates were 99% at 5 years, 95% to 96% at 10 years, 74% to 96% at 15 years, and 61% to 63% at 20 years. Caries and root fractures were the most frequently observed reasons for failure.

In a second publication based on FDPs financed by the Swedish National Dental Insurance System in the years 1977 to 1978, 104 of 262 patients were reexamined clinically and radiographically after 20 to 23 years.[9] Sixty-three percent of patients had retained their reconstructions in full extension, 18% of patients had their reconstructions reduced, and 19% lost their reconstructions. Only 73 patients could be reached for a telephone interview. Among these, 73.5% mentioned that their fixed prosthetic reconstructions had been lost.

Holm et al[10] collected information on the survival of 289 FDPs 10, 20, and 30 years after insertion in 1966/1967, 1976/1977, and 1986/1987, respectively. Eighty-seven (30%) FDPs were considered lost to follow-up, and 138 were still in function. Ninety-four (33%) FDPs were reexamined clinically, and 44 (15%) were registered by phone. No information was available for the remaining 64 (22%). The cumulative survival rates were estimated to be 72% after 10 years, 64% after 20 years, and 53% after 30 years.

For a systematic review on the survival and complication rates of FDPs, a MEDLINE search revealed 19 prospective and retrospective cohort studies with a mean follow-up of at least 5 years in which the patients had been examined clinically.[20] The 10-year probability of survival was 89.1% (95% CI: 81.0% to 93.8%).

In comparison to the gradual decrease in survival, the success rate of the FDPs in the present study suffered a more dramatic decrease from 79.8% at 10 years to 34.6% at 15 years.

The estimated cumulative risks of biologic and technical complications were grouped and included dental caries (14.8%), periodontitis (14.2%), devitalization (11.3%), and material fracture (7.4%) after 15 years. Data from systematic reviews related to survival and success rates with crowns and FDPs on teeth indicated that after 5 years, most biologic problems include caries (3.1% to 4.8%), loss of vitality (3.6% to 6.1%), and periodontitis (1.1%), and after 10 years, the incidences of caries (6.2% to 9.5%), loss of vitality (7.0% to 11.1%), and periodontitis (0.5% to 2.2%) had increased.[4] The technical complications observed after 5 years included loss of retention (2.2% to 3.3%), abutment tooth fracture (1.0% to 1.9%), and fracture of the materials (2.1% to 2.9%), and after 10 years, the instances of loss of retention (4.6% to 6.4%), abutment tooth fracture (2.1% to 3.7%), and fracture of materials (3.2% to 4.2%) had also increased.[4]

In this report, none of the assumed risk factors such as tobacco smoking, nonvital abutment teeth, cast posts and cores, absence of interdental cleaning, and presence of a cantilever extension were found to have a statistically significant effect on the survival/success rate. All analyzed incidence rate ratios for technical or biologic complications or failures were not statistically significantly different when FDPs exposed to an assumed risk factor were compared to FDPs not exposed to that risk factor. A few studies confirmed these findings, whereas in others, factors resulting in increased failure/complication rates of FDPs were noted.

Valderhaug et al[11] demonstrated that after long observation periods, the survival rates of FDPs were not influenced by the pulp vitality of the restored tooth at the time of cementation. One hundred fourteen patients received prosthodontic treatment from senior dental students at the Oslo Dental Faculty. At 25

years, 32 (28%) patients with 101 restored teeth remained in the study. Survival was defined as the fixed prosthesis remaining intact. The survival rates were 97% after 5 years, 80% after 10 years, 70% after 20 years, and 65% after 25 years. The estimated survival rates and the reasons for failure for teeth with a vital pulp and root-filled teeth were similar. The main reason for failure was caries (12%); endodontic problems in abutment teeth with an initially vital pulp were noted in 10% of patients. The survival rate of FDPs provided in a practice specialized for prosthodontics was 87% after 10 years and 85% after 15 years.[12] In contrast to the study by Valderhaug et al,[11] a greater failure rate for FDPs on endodontically treated teeth was noted.

Brägger et al[3] investigated the difference between end abutment FDPs and extension cantilever FDPs. The estimated risks for failures with end abutment FDPs and extension cantilever FDPs were 2.8% and 3.6%, respectively, after 10 years. The incident rate ratios of any negative events including all technical and biologic failures and complications were drastically increased by a factor of 4 to 8 in patients with extension cantilever FDPs compared to those with end abutments.

Data from this report have to be interpreted with caution since the high dropout rate limited the number of patients and reconstructions available at reexamination. The main reason for this limitation was that the majority of patients could not be located. Therefore, more than half of the potential patients could not be reevaluated, and the fate of their reconstructions remains unknown. In addition, there exists a possible motivational bias in that patients willing to participate in the reexamination may be in different states of health compared to those not willing to participate. Moreover, the patients were examined once, and the exact date of the occurrence of an event could not be determined. High dropout rates and unknown factors masked the effect of a potential single parameter on the outcomes.

Conclusions

This study's inherent design limitations preclude significant conclusions. However, the data suggest that metal-ceramic FDPs supported by natural teeth and fabricated by undergraduate dental students had high survival rates (90.4% after 10 years and 80.5% after 15 years). The data parallel other published results that show a time-dependent decrease in survival. The absence of biologic and technical complications and failures was drastically decreased for FDPs that had been in function for longer than 10 years.

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