Quality of fixed prosthodontics after 15 years

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Interviews and/or clinical examinations by means of the California Dental Association quality evaluation system were carried out in a group of persons who had received extensive restorative treatments with fixed partial dentures 15 years before this study. The studied group consisted of 77 persons who agreed to participate from an original group of 150 persons selected at random from the Swedish Dental Insurance System records. Of the original group 20 had died, 17 were not traceable or not able to participate for medical reasons, and 36 declined to participate. Thirty-two per cent of the recorded reconstructions had been lost, and 8% partially lost during the 15-year period. Thirty-five per cent of the reconstructions were rated as Satisfactory, whereas the remaining ones had mixed clinical quality ratings. Failures and Not Acceptable quality ratings were found to be caused mainly by fractures, loss of retention, and/or dental caries. □ *Dental caries; dental materials; denture, partial, fixed; epidemiology; insurance, dental*

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The time, complexity, and expense of fixed prosthetic treatments can be justified only if the restorations last for a long time. Many investigators have studied the long-term quality of fixed dental restorations (1–16). Most of the earlier studies used non-randomized groups of patients, treated, for example, in dental schools or in special dental clinics. Some investigators studied randomized patient populations but based their findings on second-hand information such as existing radiographs. For many years these aforementioned conditions or limitations made it difficult to draw general conclusions about the prognosis of restorative treatments in general dental practice. In 1979 our group therefore performed clinical examinations of randomly selected groups of patients. These patients had received restorative treatments from general dental practitioners 5 years before our studies—that is, in 1974 (17, 18).

These examinations were conducted by trained examiners previously standardized in the use of the California Dental Association (CDA) quality evaluation system (19). This system is based on application of tested clinical criteria. When these criteria are applied by standardized examiners, the system has been shown to be both precise and accurate in the evaluation of dental restorations and dental care (20, 21).

In the most active of our studies, the 5-year control, we examined clinically 498 fabricated crowns and 232 pontics (18). In the group examined, the mean number of units per person was 6.9, and the mean pontic/abutment ratio per restoration 0.47. Ninety per cent of the restorations examined were rated in the 'Satisfactory' quality category. Twenty-three per cent of the crowns and 49% of the pontics were rated in the top range of 'Excellence'.

The 'Not Acceptable' ratings for 10% of the crowns were found to consist of 6.6% with V-subgroup ratings. This indicates clinical situations in which damage had occurred. Three and four-tenths per cent had T-subgroup ratings. This rating indicates that treatment should be started, mainly for preventive reasons. The T-subgroup ratings were in most cases indicative of overcontouring, whereas V-subgroup ratings were usually given because of secondary caries at crown margins.

Only two of the restorations (1.8%) made in 1974 were lost during the initial 5-year period after insertion.

In 1984 our group decided to conduct a 10-year follow-up of the originally selected 150 subjects. A systematic data collection was thus started at that time. Soon it became evident that too many of the selected patients could not be located or had moved to places a great distance away. From a practical point of view it was impossible to perform the planned clinical examinations by standardized examiners. The 10-year follow-up was therefore terminated, and it was decided instead to perform a 15-year follow-up using a slightly modified method for data collection.

Materials and methods

In 1989 and 1990 all surviving subjects from the original randomly selected group of 150 patients were again contacted. In brief, the original criteria for selection of patients required a minimum cost of approximately USD400 for the dental care delivered in 1974 and the restriction of only one patient treated by any given dentist. The number, sex, mean age, and age range of the subjects at the time of data collection (1989/1990) are given in Table 1 together with reasons for exclusion from this study.

All subjects who were located (121) were offered a free clinical examination. As can be seen in Table 1, of these 121 persons 8 were found to be unable to participate for medical reasons. Another 36 persons declined to participate for various reasons, ranging from old age and demanding social situations to an admitted lack of interest in their dental condition.

In the remaining group of 77 persons who agreed to participate, clinical examinations or examinations of available files showed that for 25 of them (10 men and 15 women) the fixed partial dentures made in 1974 had been removed in total. For another group of six (two men and four women) parts of the original fixed partial denture had been removed.

From the group of 52 persons who still retained part of the original 1974 fixed partial dentures, 31 persons (15 men and 16 women) underwent clinical examinations. The standardized examiners used the same version of the CDA quality evaluation system used in 1979. The remaining 21 persons (11 men and 10 women) all lived great distances from Malmö. It was impractical, costly, and nearly impossible for them to travel to the clinical examinations. These persons were instead interviewed over the telephone. Selected questions were asked and answered concerning their subjective evaluations of the quality of their 1974 fixed partial dentures or remaining crowns.

Table 1. Mean age, age range, and sex distribution of persons selected for a long-term quality evaluation of fixed prosthodontics in 1989/1990, and exclusion criteria

	Men			Women			Total		
	No.	Mean age	Age range	No.	Mean age	Age range	No.	Mean age	Age range
Participants	36	62	43–84	41	67	45–84	77	65	43–84
Death	15	76	49–90	5	70	46–101	20	75	46–101
Not traceable	7	55	42–67	2	59	39–79	9	56	39–79
Unable to participate for medical reasons	3	87	80–94	5	85	79–94	8	86	79–94
Declined to participate	21	61	43–80	15	64	39–89	36	62	39–89
Total group	82	64	42–94	68	65	39–101	150	64	39–101

Study of some possible errors of the telephone interview method as it was used

To evaluate the overall accuracy of the telephone interview method, 29 of the 31 persons who underwent clinical examinations were also interviewed over the telephone before their respective clinical examinations.

The results of the comparisons between the telephone interviews and the subsequent clinical examinations of these 29 persons showed that for 16 of them (55%) there was good correlation between the results of the two data collection methods. In this group of persons all major defects subsequently recorded clinically were also described by the patients at their initial telephone interviews. In the remaining group of 13 persons (45%) a certain lack of communication became evident. For 12 of the 13 persons the difference was found to be due to a subjective overrating of quality by the patient. In this group seven persons failed to sense crown/pontic overcontours or crown margin defects. The remaining five patients were not aware of the presence of limited caries defects along crown margins. The one person who underrated the quality of the 1974 fixed partial dentures did so by mistake. He mistook a poor-quality fixed partial denture of later vintage located in the same quadrant for the 1974 restoration.

Considering the results of this comparative test from a general methodologic point of view, data collected at the telephone interviews were useful even though they described a somewhat better situation than found at the clinical examinations.

Results

The results of the 15-year clinical examinations and interviews are given in Table 2 together with the corresponding results from the 5-year control data.

As can be seen in Table 2, at the 15-year examination approximately one-third of the restorations were lost.

Another approximately one-third was recorded as Satisfactory, whereas the rest was found to consist of crowns and pontics varying in quality.

For 25 of the persons (32.5%) one or more Not Acceptable quality ratings were recorded. Even though one of the data collection methods obviously has a tendency to picture a fairly bright situation, it is still of interest that almost all of these cases were related to dental caries, crown/pontic overcontours, and/or crown margin defects.

The reasons for removal of the restorations are given in Table 3. The reasons were given by the selected subjects or found in their dental records. As can be seen, the most frequent reason for total or partial removal of the restorations found at the 15-year recall was fracture of the fixed partial dentures and loss of retention. The data collected also indicated a large number of these technical failures were associated with dental caries in one or more of the abutment teeth.

For a comparatively large number of the

Table 2. Status at 5 and 15 years of extensive fixed partial dentures of conventional design (%)

	Five-year (1974) status (n = 109)	Fifteen-year (1989) status (n = 77)
Only Satisfactory reconstructions	49.5	35.1
Satisfactory and Not Acceptable reconstructions	46.9	32.5
Only Not Acceptable reconstructions	1.8	0
Partially lost reconstructions	0	7.8
Lost reconstructions	1.8	32.5

Table 3. Reasons (%) for total ($n = 25$) and partial ($n = 6$) removal of extensive fixed partial dentures of conventional design during a 15-year period

Fracture or loss of retention	51.7
Cosmetically unacceptable conditions	3.2
Dental caries	9.6
Specific reason not found/not recorded	35.5

removed restorations no single reason could be identified in available dental records or be remembered by the patients. Rather, an absolute majority of these 11 cases showed a mix of several negative clinical conditions. These conditions seemed to substantiate the decision to revise the treatment.

Discussion

Increased understanding of the etiologies of dental caries and periodontal disease has made it possible to attain levels of relative control over these diseases in the Western world. The number of extractions is thus rapidly declining in European and North American populations. The edentulous person is becoming uncommon or even rare in groups of young and middle-aged people. Consequently, the willingness to accept removable prosthetic appliances is decreasing or even disappearing. Whenever extractions still have to be performed, there is a combination of dental, psychologic, or sociologic factors working in favor of selecting a fixed prostheses as the preferred restorative treatment.

Although there is strong indirect evidence to support the preference of fixed to removable appliances, few scientific studies have been reported in this area.

Because of the administrative burden and complexity of carrying out periodic clinical reexaminations of large groups of patients, few long-term, population-based studies have been reported in the field of fixed prosthodontics. We know from frequent case reports and limited, non-randomized studies (1–6, 9, 10, 22) that individual treatments with various types of fixed partial dentures can be successful for several decades, but we still have little information about the average service life for common types of fixed prosthetic restoration. This is especially true for treatments performed by general practitioners.

This is not a satisfactory situation. We need discussions with both patients and government agencies about the prognosis for the various types of prosthetic treatments, and these should be founded on a scientific basis.

In Sweden the introduction of a Federal Dental Insurance program in 1974 considerably increased the possibility to identify treated subjects and to study the outcome of dental treatments carried out in this population of over 8 million people. The Swedish Dental Insurance Program involves every Swedish citizen and virtually every Swedish dental practitioner. This program covers the most extensive and expensive types of treatment. Since the number of restorative treatments not covered by the Federal Insurance Program is much less than 1% of all treatments performed, these can be ignored in discussion about the overall quality of restorative treatments in Sweden.

During the most recent 15-year period at departments of prosthetic dentistry of Swedish dental schools a series of epidemiologic studies have been completed. The studies are on the long-term results of a range of restorative treatments using fixed partial dentures provided by general practitioners. These studies have focused on the quality of both conventional and extensive fixed partial dentures (11–13, 18). The studies also considered the possibility of adverse biologic reactions to fixed prosthetic appliances (17).

The patients participating in these studies were selected at random from patients originally treated during the period 1974 to 1976 as recorded in the files of Federal Dental Insurance agencies. In two of these studies (17, 18) the California Dental Association (CDA) Quality Evaluation Criteria were used at the clinical evaluations (19, 20). In the other studies (11–13) similar, non-standardized data collection systems were used.

In the study of conventional fixed partial dentures by Glantz et al. (18) the data collected showed that after 5 years in service only two restorations were lost. By any

bioengineering standard this survival rate of 98.5% must be considered a superb success rate.

At the 15-year reexamination of the same group of persons the failure frequency had increased to 32.5%. The resultant survival rate of 67.5% at 15 years, although markedly reduced, must still be considered satisfactory. Further, as indicated in the literature, it is probably higher than the corresponding value for removable partial denture treatments in groups of non-supervised patients (23). It is in fact probably only surpassed by the survival rates for the biomechanically less complex implant-supported fixed partial dentures (24).

The recorded survival rate of 67.5% is lower than that reported by Karlsson (12) in a similar follow-up study of an original group of 642 patients who had been treated with fixed partial dentures by general practitioners (25, 26). That follow-up, which was conducted on 97 persons from an original subgroup of 164, showed a comparative survival rate of 83% after 14 years.

There can be several reasons for the noted difference in survival rates, including observation time, bridge extension, and abutment teeth distribution and vitality. These factors have previously been reported to be of importance for the length of useful service life of fixed partial dentures (12, 13). The precision of epidemiologic studies is strongly and directly related to the data retrieval frequency. This fact could be of significance in this study, since the overall retrieval rate was 51% (64% of those located) with 37% clinically examined (46% of those located). The corresponding number of retrieved and clinically examined persons at the 14-year follow-up was, however, only 17% of the total original group and 59% of the original clinically examined group (12). Nothing certain can be said about the lost patients in any of these studies.

Outside Sweden few reports have been found in the literature on the long-term clinical quality of restorative treatments with fixed partial dentures by general practitioners. If the Swedish data are compared with available international reports, albeit of short duration and including less extensive restorations, often on non-randomized patients, it is evident that in general terms the Swedish data correspond well with the international data (14, 27, 28).

Any seemingly systematic difference could be due to several facts, ranging from variation in quality criteria to different treatment traditions and competence among general practitioners.

The results of this study indicate that, either singularly or in combinations, fractures, loss of retention, and dental caries are the most frequent reasons for both failures and Not Acceptable clinical quality ratings after long-term restorative treatments with fixed partial dentures of conventional design. This is an overall observation that coincides with those previously reported in similar studies, including those by Randov et al. (13), Walton et al. (14), and Karlsson (12). Even though dental caries is a disease that at present seems to be under reasonable control, especially in many younger populations, in subgroups of middle-aged people who have received treatments with relatively extensive fixed reconstructions dental caries is still a cause of major dental problems. The results of this study thus indicate that the two main restorative areas in which improved knowledge is at present needed among general practitioners are bioengineering principles and dental caries prevention.

From the results of this study it also becomes evident that the half-life is close to and slightly more than 15 years for comparatively extensive fixed partial dentures with a conventional design. This must be considered both a satisfactory outcome of a complex restorative treatment and a sound economic investment for the patient. Thus, in today's money and according to the Swedish dental fee scale, the sum written off for the average treatment in this study will be only USD 0.30 a day. This is a favorable value in comparison with other restorative dental treatment modalities (29).

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