

Retrospective Audit of Patients with Advanced Toothwear Restored with Removable Partial Dentures

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Abstract – The dental records of 50 patients with advanced tooth wear restored with removable prostheses were examined. Retrospective data were collected with regard to source of referral, presenting complaint, aetiological factors, clinical features, dentures provided, details of failures and maintenance. The maximum follow up period was three years. The ratio of male to female patients was 4:1 and the age range 31–75 years. Failures were recorded in 38% of patients with provisional and 64% with definitive dentures. The most common failure was fracture or wear of the incisal or occlusal surfaces. The majority of failures were addressed by adjustment of the dentures and the audit confirmed the need for regular maintenance.

KEY WORDS: Denture, partial, overlay; Audit; Outcome.

INTRODUCTION

The term tooth wear was proposed by Smith and Knight¹ to describe the sole or combined effects of abrasion, attrition and erosion on the teeth. They considered that the use of the general term tooth wear is necessary especially in the absence of a clear aetiology. Tooth wear is often the result of a combination of causes^{1,2} and so it is inappropriate to use a specific term that implies cause and effect.

Tooth surface loss was introduced as an alternative term by Eccles³. Other terms used are occlusal wear^{4,8}, horizontal tooth wear⁹ and dental wear^{10,11}. The term tooth wear will be used in this article.

Several authors state that they have the impression that the prevalence of tooth wear is increasing^{3,10} but there is a need for national and longitudinal data. The management of patients with tooth wear has also been recognised as an increasing problem¹². Watson and Tullock¹³ considered that an increasing number of cases of tooth wear were being referred by general dental practitioners to Consultants in Restorative Dentistry and Callis *et al.*¹⁴ reported that 22% of referrals to the Conservation Department of Edinburgh Dental Hospital concerned tooth wear.

The reasons given for this alleged prevalence are that patients are keeping their teeth longer and are living longer^{3,15}. The Adult Dental Health Survey¹⁶ calculated that if the current decline in the proportion of adults becoming edentulous continues at its present rate, the proportion of edentulous adults will decrease to 10% by the year 2008 and the survey sets a goal of 95% of the adult population retaining some natural teeth by that year. There is a consensus view that increased tooth wear is found with increasing age and that wear is more severe in

men than in women^{17,18}. Also, changes in patients' attitudes to dental function and appearance may result in an increased demand for dental care^{10,15}. Epidemiological data concerning the presentation of such patients attending for treatment, and their attitudes toward tooth wear and its treatment is limited.

The restoration of tooth wear with removable partial dentures to restore appearance and function is well established. The dentures may cover the worn surfaces partially by onlaying the incisal or occlusal surfaces or completely by overlaying the worn teeth or by using an overdenture. The techniques available are comprehensively described in the literature^{19–38}, but no longitudinal data are available on the relative merits of these treatments.

Reports of the outcome of treatment of patients with advanced tooth wear restored with partial dentures are limited. Hussey and Linden³⁹ reported that 27% of overdenture abutment teeth developed caries after 2 years in a group of patients where tooth wear was cited as the primary reason for providing an overdenture. Compliance with topical fluoride prescription was relatively poor. This data is comparable with that reported in studies of conventional overdentures^{40–42}.

The purpose of the current study was to establish the clinical profile of patients with tooth wear referred to the Eastman Dental Hospital, and the outcome of both provisional and definitive treatment provided. A retrospective study of 50 patients, with advanced tooth wear, treated with removable partial dentures covering the worn teeth, was carried out. The purpose of the audit was to establish the clinical profile of patients with tooth wear referred, to assess the provision and outcome of treatment provided, to enable a prospective study to be set up and to improve patient care.

METHOD

Fifty patients with advanced tooth wear, who had been provided with removable partial dentures covering the

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Table 1. Data capture form for clinical data collected from notes of 50 patients with advanced tooth wear.

Category	Classification					
DOB						
Gender	Male	Female				
Source of referral	GDP	GMP	Hospital	Community	Other	EDH
Presenting complaints	Appearance	Function	Pain	Unaware	Other	
History of complaint	Weeks	Months	1 to 5 years	>5 years		
Attitude to treatment	Unconcerned	Avoid deterioration	Seeking active treatment			
Erosive habits	Dietary	Gastric	Both	None		
Bruxing habits	Day	Nocturnal				
Teeth present	(11-48)					
Plaque control recorded	Yes	No				
Probing depth	≤3mm.	3-6mm	≥6mm			
Site of tooth wear	Maxillary anterior	Maxillary posterior	Mandibular anterior	Mandibular posterior		
Radiographs	Yes					
Radiographic bone loss	≤1/3	>1/3 ≤2/3	>2/3			
Radiographic crown height	≤1/3	>1/3 ≤2/3	>2/3			
Diagnosis	Attrition	Erosion	Abrasion	Combination		

worn teeth during 1990 and 1991 were entered into the study. They were identified via the system of diagnostic and treatment coding in the Department of Prosthetic Dentistry at the Eastman Dental Hospital.

The clinical data to be collected were presented and discussed at Departmental Audit Meetings. Data were collected from the case notes by three clinicians (BG, KH, NW) and then transferred to a data base by an audit assistant.

A sample of 20 case notes was used for a pilot study. Inter clinician agreement was confirmed by the notes being re-scored by a second clinician. Where queries or inconsistencies were found a consensus view was sought. Following the pilot study modifications were made to the data base. Terms and questions were re-defined or re-phrased as appropriate.

The data capture form is shown in Table 1. A clinical profile of the population treated was established from the records. The terms of reference were; age, gender, habits, teeth present, severity and site of tooth wear, extent of tooth loss, degree of bone loss, plaque control, periodontal probing depths and diagnosis of the aetiology of tooth wear.

Dietary or gastric erosive factors were noted, in addition to day-time or nocturnal bruxing habits. The site of teeth with wear was recorded as anterior (canine to canine) and/or posterior, in both the maxilla and mandible. Severity of tooth wear was assessed on radiographs and confirmed on re-examination of the patients. In view of the extensive tooth wear in these patients the reduction of crown height was recorded as less than one third, one third to two thirds or greater than two thirds.

Bone loss was assessed radiographically and recorded as less than one third of the root length, one third to two thirds or more than two thirds. This was designed to give a gross indication of periodontal destruction for this group of patients.

Data regarding the patients' presenting complaint and attitude to treatment and the provision and outcome of treatment were collected. The areas of interest with regard to the treatment provided were as follows:

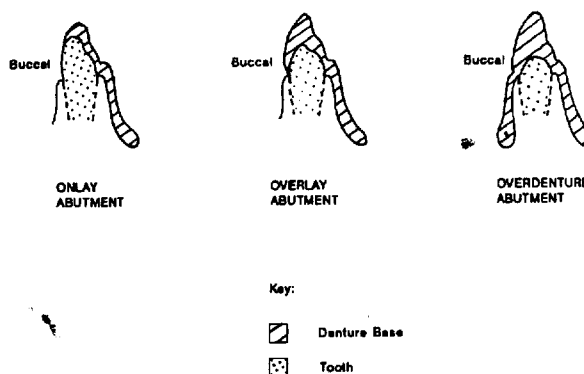


Figure 1. Types of tooth cover provided by a denture to restore tooth wear.

- **Source of referral.** This was classified as an external referral: from the General Dental Practitioner (GDP), the General Medical Practitioner (GMP), hospital or community dental services, or internal from within the Prosthetic Dentistry department or other department in the Eastman Dental Hospital.
- **Waiting times.** These were recorded between the initial consultation to the start of treatment with the first impression.
- **Dentures provided.** Treatment was provided according to the principles described in Hemmings *et al.*¹⁹. Details of provisional and definitive dentures constructed for maxillary and mandibular arches were collected. Provisional dentures included acrylic splints which were constructed with or without denture teeth, depending on the extent and distribution of tooth loss. Tooth coverage was classified as onlay if only the occlusal or incisal surface of the teeth was covered, overlay where the occlusal and buccal surface were covered and overdenture where the tooth was covered and a buccal flange provided (Figure 1). In some instances the denture provided would include all three design elements these were recorded as a combination design.

TOOTHWEAR AUDIT

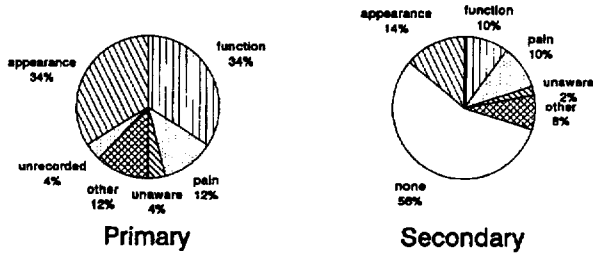


Figure 2. Primary and secondary presenting complaints of patients with advanced tooth wear (n=50).

- **Failure.** Details of failures were recorded including the number, timing and nature of the failure and the action taken
- **Recall procedures.** The frequency of reviews and the length of maintenance were recorded. The recall programme was 1,3,6,12 months then annually.

RESULTS

Patient presentation

- **Age and gender**
Thirty-nine males and 11 females with a mean age of 57.8 years (range 75 to 31 years) formed the audit population.

- **Complaints**
Primary and secondary patient complaints are illustrated in Figure 2. The main complaints were those of appearance and function.

Twenty per cent of patients gave a history of over five years for their presenting complaint. Thirty per cent considered that their complaint had been present for between one and five years, 18% for 'months' and 10% for 'weeks'. In 22% the history of the presenting complaint had not been recorded.

- **Attitude towards treatment**
Eighty-four per cent of patients expressed a desire for treatment. Six per cent were unconcerned about their problem, 2% wished to avoid any further deterioration and in 8% attitude to treatment was not recorded.

- **Habits and aetiology**
An erosive habit was recorded for 34% of patients. This was dietary in origin in 10%, from gastric regurgitation in 18% and a combination of dietary and gastric factors were identified in 6%. No cases of industrial erosion were identified. A bruxing habit was recorded in 44% of patients.

A diagnosis of the tooth wear aetiology was recorded in 88% of the notes. Attrition was diagnosed for 54% of patients, erosion for 2% and a combination of attrition and erosion for 32%.

Clinical profile

- **Extent of tooth loss**
The patients had an average of 20 teeth (range 9 to 29). On average only one tooth was missing in the anterior region of each jaw, compared to five posterior teeth.

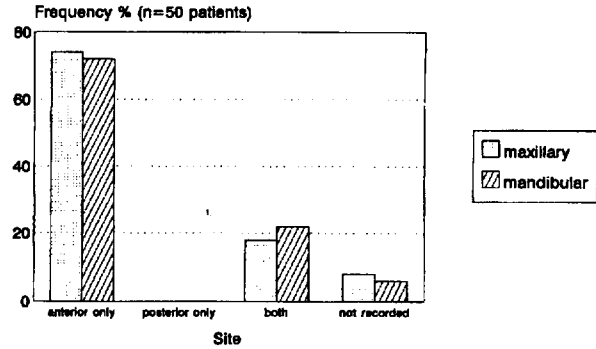


Figure 3. Site of tooth wear, both in maxillary and mandibular teeth in 50 patients with advanced tooth wear.

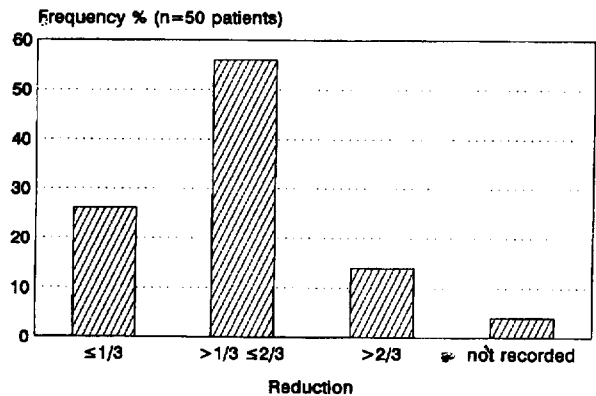


Figure 4. Average reduction in crown height in teeth presenting with tooth wear in 50 patients.

- **Severity and site of tooth wear**
The site of tooth wear is illustrated in Figure 3. The severity of tooth wear is illustrated in Figure 4. Radiographs were unavailable for the estimation of tooth wear in 4% of patients.

- **Periodontal profile**
Reference to plaque control was made for 70% of patients. Periodontal probing depths were recorded in only 30% of patient notes. Sixty-eight per cent of patients had an average bone loss of less than one third of the root length and 26% had bone loss of one third to two thirds.

Provision of treatment

- **Referral pattern**
Seventy-eight per cent of patients had been referred by their general dental practitioner, 20% were long standing patients of the hospital and 2% were referred from other hospitals. Of the internal referrals 90% came from the Department of Conservative Dentistry. Sixty per cent of the patients had received treatment in one or more of the other hospital departments previously.
- **Waiting time**
The average waiting time from initial consultation to the start of treatment was 3.2 months (SD 3.84, minimum 0 and maximum 16).
- **Dentures provided**
Twenty-nine provisional dentures were provided for 24 patients and 56 definitive dentures for 44 patients, 18 patients had both provisional and definitive treat-

Table 2. Details of provisional and definitive dentures provided in the maxilla and mandible of 50 patients.

Type of denture	Number of dentures provided		Definitive	
	Provisional Max.	Mand.	Max.	Mand.
Partial overdenture	1	0	4	4
Partial overlay	5	8	3	8
Partial onlay	0	0	3	8
Partial combination	5	2	15	7
Complete overdenture	0	0	2	0
Complete overlay	0	0	1	0
Splint	8	0	0	0
Total	19	10	28	27

Table 3. Details of site of tooth coverage in provisional and definitive dentures.

	Provisional		Definitive	
	Max.	Mand.	Max.	Mand.
Anterior	6	7	18	14
Posterior	0	0	0	6
Both	13*	3	10	7
Total	19	10	28	27

* 8 splints

ment. The details of dentures provided is given in Table 2.

Provisional treatment was provided for 16 patients who had provisional dentures with tooth coverage and eight who had maxillary occlusal splints. Thirteen patients with dentures and five with splints went on to have definitive dentures. The remaining patients continued with their 'provisional' appliances.

The majority of provisional treatments provided patients with maxillary tooth coverage (68%). Tooth preparation was carried out prior to provisional treatment in 20% of patients.

Definitive treatment was generally more complex with tooth preparation in 80% of patients involving tooth coverage in the maxilla and mandible. Details of the site of coverage is given in Table 3. The definitive treatment was not preceded by a previous denture with tooth coverage or provisional therapy in 8 cases.

Failures

Provisional dentures. Forty-two per cent of patients experienced one or more failures in wearing their prostheses. The types of failure are described in Table 4. Failure precipitated construction of the definitive denture in three patients. The timing of the failures and the length of recall of patients with provisional dentures are illustrated in Figure 5a, two patients had four failure episodes each (Figure 6).

Definitive dentures. Fifty-nine per cent of patients experienced one or more failures in wearing their prostheses. The types of failures are described in Table 4. The timing of the failures and the length of recall of patients with definitive dentures are illustrated in Figure 5b, three patients each experienced 5 failure episodes (Figure 6).

Generally the action taken following failure was repair, eight prostheses required remaking and no action followed eight failures. The action following two of the failures was not recorded.

Table 4. Details of the number and type of failures in 50 patients with provisional and/or definitive dentures.

Type of failure	Number of failures	
	Provisional	Definitive
Anterior occlusal surface fracture	4	17
Posterior occlusal surface fracture	6	9
Base fracture	5	5
Anterior occlusal surface wear	1	4
Posterior occlusal surface wear	0	3
Appearance	1	1
Retention	0	1
Problems with eating	0	1
Problems with speech	0	1
Unknown	1	7
Other		
Unable to wear	1	1
Nausea	3	0
Difficulty on insertion	0	2
Pain	0	3
Caries	0	1
Abutment fracture	0	1
Total	22	57

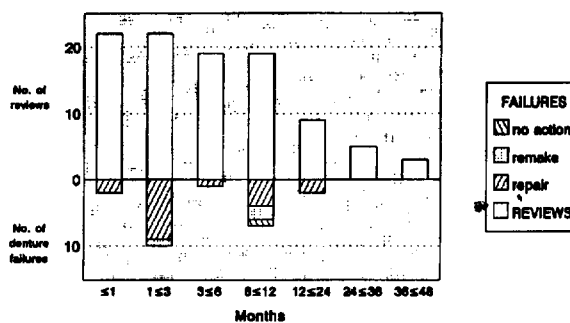


Figure 5a. Timing of reviews and failures of provisional dentures with tooth coverage, together with action taken.

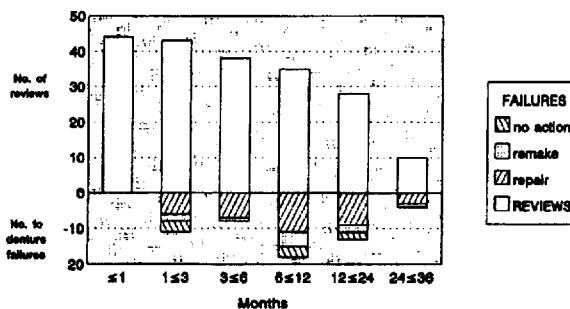


Figure 5b. Timing of reviews and failures of definitive dentures with tooth coverage, together with action taken.

Recall procedures

The pattern of patients attending for recall are shown in Figures 5a and 5b. Twenty-two per cent of patients were discharged back to their GDP, and 4% were continuing active treatment. Twenty-two per cent failed to continue their maintenance programme.

DISCUSSION

A number of problems were identified in conducting the audit and were addressed by a variety of methods.

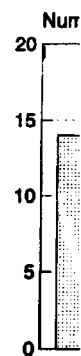


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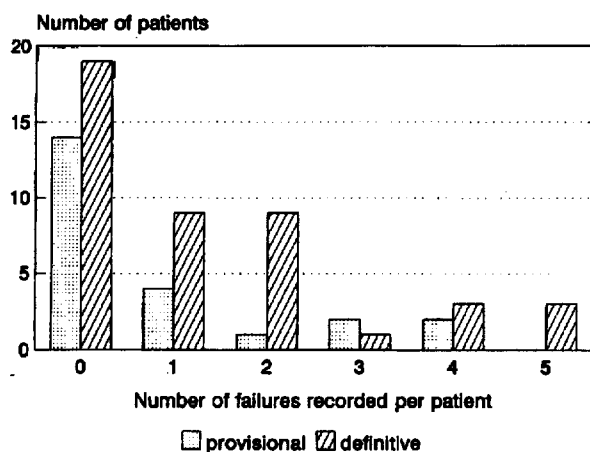


Figure 6. Bar chart illustrating the frequency of denture failures per patient.

• Missing or incomplete data

A proportion of questions were not possible to answer from our retrospective analysis of the case notes. This was as high as 44% for the question "does the patient have an erosive habit?" and 70% of patients had no indication of pocket depths recorded in their notes. Although some details, for example on denture design and on the current status of dentures where patients had failed to be reviewed, could be completed by recalling patients, some information such as periodontal status at the start of treatment could not be retrieved. This is a disadvantage of a retrospective audit and has been educational in designing a prospective audit with an initial examination sheet to improve the quality of record keeping and act as an aide-memoir to the clinician.

• Inter-rater agreement

This is a problem with any survey that involves more than one assessor. We found a pilot study of 20 case notes useful to re-define or re-phrase terms and questions for clarity as did Packer, Scott and Watson⁴³. Inconsistencies were analysed by the assessors and the results corrected or agreed upon.

• Data collection by non clinical staff

This was found to be impractical. Packer, Scott and Watson⁴³ also found that retrospective analysis of dental case notes was too complicated to be carried out by anyone except a clinician.

The initial examination sheet developed as a result of this audit has been designed to facilitate reading by non-clinicians.

• Establishing criteria for success

Success criteria for provision and outcome of treatment can be difficult to define. This audit has concentrated on reporting type of treatment provided for a well defined population, and mechanical or biological success or failure, as noted by patient complaint or operator observation, with a view to setting a protocol and standards for a prospective study.

Several epidemiological studies^{17,44,45} have reported a high male to female ratio in the prevalence of advanced tooth wear in the populations examined, and this increased with increasing age. This trend was also found in patient referrals for tooth wear by Callis *et al.*¹⁵. In the current

survey a higher proportion of males than females (4:1) attended for the treatment of tooth wear.

Despite the aetiology of tooth wear not being comprehensively recorded, a diagnosis was made for 88% of patients. The diagnostic criteria for the assessment of aetiology would need to be clarified for a prospective study, especially given the difficulties of obtaining a history in patients with erosive factors related to alcohol intake or voluntary gastric regurgitation⁴⁶.

Analysis of the teeth present revealed that this group of 50 patients, despite having advanced wear, was relatively dentate.

The extent of tooth loss was similar in both maxillary and mandibular arches, with a substantially greater loss of posterior teeth compared to anterior teeth. A greater reduction of crown height was recorded in anterior teeth.

The relatively short waiting time for treatment reflects the priority given to patients requiring partial dentures to restore advanced tooth wear at the Eastman Dental Hospital.

The construction of provisional dentures for patients with advanced tooth wear has been suggested to fulfil a variety of objectives¹⁹;

- To confirm the retruded contact position in the horizontal plane, most especially the antero-posterior relationship.
- To establish whether an increase in occlusal vertical dimension can be tolerated.
- To explore possible changes in appearance, in particular with regard to anterior tooth position.
- To test the patient's motivation and tolerance of denture wearing. The provisional denture is frequently regarded as a reversible treatment.

A definitive denture should fulfil the objectives of the provisional denture with regard to appearance and function, copying those aspects of the design which have proved successful. The treatment should be designed with thought to low maintenance and durability in the long term. The appearance of the definitive denture may also be improved by design modification following tooth re-contouring.

In this survey 13 patients had provisional dentures followed by definitive dentures. A further 23 patients had definitive dentures which replaced old or unsuccessful dentures with tooth coverage. Only eight patients launched straight into definitive treatment. These were not associated with an increased number of failures.

There was evidence that in general the provisional treatment was relatively simple and reversible with provision of an acrylic denture in one arch without tooth re-contouring. Provisional dentures for five patients were considered both by the operator and the patient to be satisfactory as definitive dentures.

Ten patients experienced failure of their provisional denture and 50% of the failures involved wear or fracture of the occlusal surfaces. Early failures support the construction of the definitive dentures as soon as the objectives of the provisional treatment have been realised. It would be hoped that such failures would be reduced by recontouring of abutments and provision of definitive dentures. Although 43% of patients with definitive dentures had no failures, fracture or wear of occlusal or incisal surfaces accounted for 47% of all failures. This highlights the need for a recall programme, but also for

the development of new restorative materials and modified designs.

The problems of appearance identified by the patients on presentation were apparently addressed by the treatment, with the exception of only one patient in provisional and one in definitive therapy. Problems associated with the abutment teeth were few, but the potential problem of caries developing in dentine surfaces covered with prostheses must not be overlooked and again emphasises the need for a maintenance programme. This is supported by the evidence of conventional overdentures⁴⁰⁻⁴².

CONCLUSIONS

The clinical profile of 50 patients with advanced tooth wear who were treated between 1990-1991 has been compiled via a retrospective audit. The patients were considered a priority group for treatment. The outcomes documented were the type of denture provided and details of failures. The failures indicate the importance of maintenance programmes and the need to develop materials and treatment methods. This audit has formed the first part of the audit cycle and has been used to improve information recorded. A prospective study has been designed as a result.

ACKNOWLEDGEMENTS

Our thanks are due to Ms. J. Robinson for her work in the capacity of audit assistant, Dr. E. Petri for her statistical advice, and Ms. S. Lendor for her assistance with preparation of the manuscript.

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