The suitability of a new index for the evaluation of dental wear

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The suitability of a new index for rating dental wear by different observers was tested. Four dentists, who were first calibrated using the scoring system and then subjected to an inter-examiner agreement test before and after a field study, rated 167 individuals in total in their private dental practices. The incisal/occlusal state of the teeth with regard to restorations and dental wear was recorded. The inter-examiner agreement test proved satisfactory when rating main groups of wear but not so good when rating subcategories. However, a marked improvement in agreement developed between the first and the second test. The individuals composing the field study group are probably not representative of Scandinavian populations in general. Relatively few teeth were missing, and the teeth were well restored. Only the highest age group (80–89 years) displayed the most severe degree of wear to any extent. However, wear into the dentin was observed in 20% of the teeth already in the youngest age group (20–29 years). These teeth were solely incisors and canines of both jaws. In conclusion, we found that the index should be well suited for the evaluation of dental wear in large groups of people by different investigators after adequate training in use of the system has been provided and that tooth wear may be a relatively small problem in urban Scandinavian populations with regular dental care. □ *Clinical study; tooth wear; wear index*

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To judge from the interest shown in the treatment of worn teeth by Scandinavian colleagues, such teeth may appear to be of increasing occurrence in the population. Little is known, however, about the prevalence of worn teeth in general, although they have long been a problem for many individuals and in certain groups of people in particular (1–5).

The apparent increase in prevalence of tooth wear may not be real but rather due to changes in the patients' concern about the functional and esthetic state of their teeth, causing fewer to be pulled because of excessive wear. Greater demands are therefore placed on the dental profession to prevent and treat tooth wear. However, the decision as to when treatment, and especially irreversible treatment such as capping, is necessary may be difficult even from a purely dental point of view. In addition, individual demands and economic obstacles may complicate the decision. In an attempt to overcome some of these difficulties an index based on Ryge's system, in which the main decision of whether treatment is necessary or not is a basic criterion, was introduced (6). The index is based on a professional judgement of the need for treatment. It was hoped that it might help to establish certain subjective dental criteria for the present and future evaluations of tooth wear and need for treatment.

The aim of the present study was to test the suitability of this index when scoring dental wear in random patients consecutively attending a dental checkup by four different observers in their own private dental practices, and to establish the wear situation in such a clientele in accordance with this index.

Materials and methods

The study consists of two parts, a study of

Table 1. Subjects examined

Age groups, years	Men	Women	Men and women
20–29	12	10	
30–39	12	7	
40–49	16	17	
50–59	16	23	
60–69	13	21	
70–79	6	10	
80–89	2	2	
Total	77	90	167
Mean age	48.0	52.7	50.5

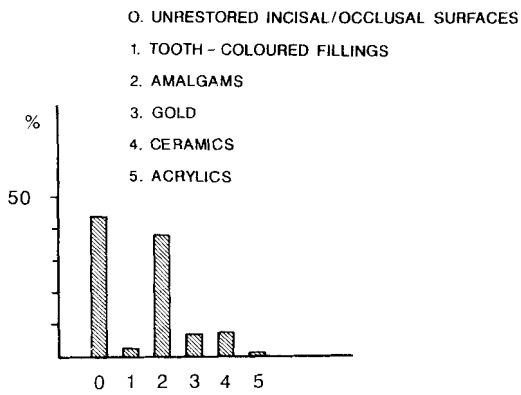

Fig. 1. Percentage distribution of incisal/occlusal state of restoration.

inter-examiner agreement and a field study of dental wear. The inter-examiner agreement study was performed on 11 subjects who were examined twice, once before and once after the field study. Two of the examiners, who had not taken part in either of the previous studies (6–8), were given a short introduction to the use of the index, and calibration of all examiners was done by scoring some individuals in common and discussing the results. Deviations in interpretation of the criteria were thus solved. The 11 subjects were then scored by all 4 dentists independently in accordance with the index. On the basis of an acceptable inter-examiner agreement, the field study was started.

The field study group comprised regular patients due for their annual checkup in four private dental practices. Missing teeth were recorded, as was the incisal/occlusal state of restoration of all teeth present. The degree of incisal/occlusal wear was classified in accordance with the criteria described by Øilo et al. (6). The index consists of three categories of satisfactory degree of wear—Romeo (R), Sierra (S), and Mike (M)—and two categories of not acceptable degree of wear—Tango (T) and Victor (V) (for description, see Table 3). All categories except Romeo contain subcategories. To overcome the problem of grading the wear of restorations, two extra subcategories of group M were introduced in addition to those described previously (6)—that is, large wear facets in restorative material (MWR) and perforation of crown with hard, non-sensitive dentin exposed (MED-P) (for description of subcategories, see legend to Fig. 3).

The patients from the four practices were pooled, and the findings evaluated as being derived from one group of individuals divided into seven age groups from 20–29 years up to 80–89 years. The age and sex composition of the material as a whole is presented in Table 1.

Differences in wear ratings between women and men were evaluated statistically by a RIDIT analysis (9).

Findings

The inter-examiner agreement tests showed on the first occasion that examiner 2 had 11.2% disagreement with examiner 1, examiner 3 had 12.9% disagreement, and examiner 4 had 15.6% disagreement when scoring main categories of wear. On the second occasion these figures had changed to 4.5%, 4.1%, and 3.3%, respectively. When scoring subcategories, examiner 2 had 16.0% disagreement with examiner 1, examiner 3 had 12.5% disagreement, and examiner 4 had 37.3% disagreement on the first occasion, whereas on the second occasion these figures were 14.2%, 11.8%, and 24.4%, respectively.

The total number of patients examined was 167, with a mean age of 50.5 years. There were 90 women, with a mean age of 52.7 years, and 77 men, with a mean age of 48.0 years (Table 1).

Table 2. Percentage distribution of incisal/occlusal state of restorations and missing teeth in relation to age

Age, years	Occlusal/incisal state*						
	0	1	2	3	4	5	6
20–29	69.5	0.4	43.8	0	0.9	0.2	8.5
30–39	47.3	0.2	47.0	1.5	3.6	0.4	13.5
40–49	38.8	4.1	43.5	4.0	8.8	0.8	14.9
50–59	40.4	2.8	43.2	5.6	6.4	1.2	17.7
60–69	41.0	2.3	26.5	14.0	14.5	1.7	25.6
70–79	35.4	4.6	27.1	15.9	7.8	1.0	27.4
80–89	35.6	3.4	17.2	35.6	8.0	0	32.0

* 0 = unrestored incisal/occlusal surfaces; 1 = tooth-coloured fillings; 2 = amalgams; 3 = gold; 4 = ceramics; 5 = acrylics; and 6 = missing.

Four hundred and ninety-nine teeth were missing in the upper jaw and 490 in the lower, leaving 4355 teeth to be scored. The percentage distribution of the incisal/occlusal state of restoration of all teeth is presented in Fig. 1. Forty-four per cent were unrestored, 2.5% had tooth-colored fillings, 38% were filled with amalgam, 7.1% had gold covering these surfaces, 7.4% had ceramics, and 0.9% had acrylic restorations. The women had most tooth-colored fillings and ceramic crowns, whereas the men had most amalgams.

Table 2 presents the percentage distribution of the incisal/occlusal state of teeth and missing teeth in relation to age groups. The percentage of unrestored teeth was reduced by about one-third from the youngest to the next age group and by another 10% in the one thereafter, remaining constant for the rest. Teeth with tooth-colored fillings were few. Most of them were found in age groups 40–49 and 70–79 years. The percentage of amalgam-restored teeth was about the same in the first four groups (approximately 45%), being reduced by about one-third in the next two groups. For gold there was a gradual increase from zero in age group 20–29 years to 35.6% in the oldest age group. Ceramics showed a varied increase with a peak of 14.5% in the 60- to 69-year group. Acrylic resins were hardly used in any of the age groups. The percentage of missing teeth showed an almost linear increase from 8.5% in the youngest age group to 32.0% in the oldest. The mean number of missing teeth was 6.5 among the women and 5.3 among the men.

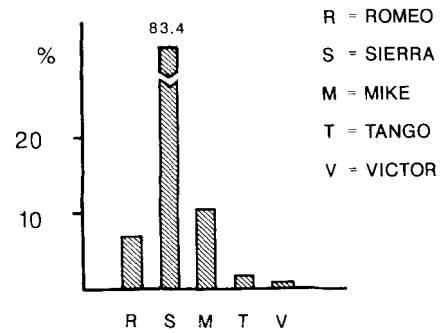

Fig. 2. Percentage distribution of teeth in main categories of wear.

The rating of the main categories of wear is presented in Fig. 2. Four and a half per cent of the teeth were rated as R, 83.4% were rated as S, 11.5% were rated as M, 0.45% were rated as T, and 2% of the teeth were rated as V (for definitions of ratings, see Table 3).

When calculating an individual state of wear—determined as the most severe wear found within 90% of the single tooth ratings when starting from Romeo (6)—no difference was found between the sexes. For men a mean RIDIT value of 0.52 was found; for women, 0.47. Both values have a 95% confidence interval overlapping 0.5. The percentage of each main wear category in

Table 3. Percentage distribution of each category of wear in relation to age

Age, years	Category of wear*				
	R	S	M	I	V
20–29	13.2	84.0	2.8	0	0
30–39	4.0	89.5	6.5	0	0
40–49	4.1	87.2	8.1	0.3	0.2
50–59	1.4	83.0	15.0	0.7	0
60–69	4.1	80.1	14.3	1.0	0.5
70–79	1.1	78.8	19.8	0.3	0
80–89	0	58.6	37.9	0	3.4

* R = no visible wear or change in anatomic form; S = limited (normal) wear; limited change in anatomic form; M = considerable wear with obvious change in anatomic form but without need for treatment; T = considerable wear with marked change in anatomic form; further damage to tooth and/or surrounding tissues is likely to occur; and V = excessive wear; extreme change in anatomic form, esthetics, and function; pain on chewing; damage to tooth and/or surrounding tissues is occurring.

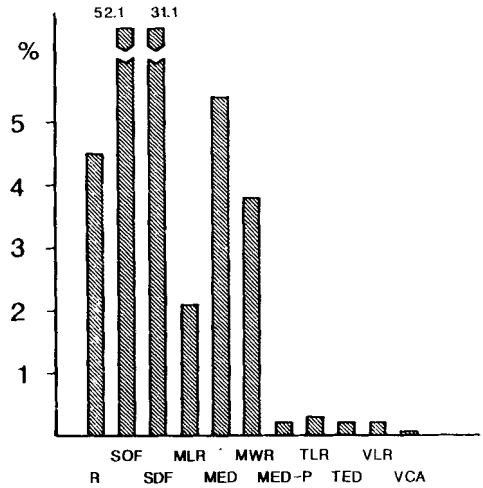

Fig. 3. Percentage distribution of teeth in subcategories of wear. R = no visible wear; SOF = wear facets in enamel; SDF = small areas of exposed dentin; MLR = obvious length reduction of tooth; MED = large areas of exposed, hard dentin; MWR = large wear facets in restorative material; MED-P = perforation of crown with hard, non-sensitive dentin exposed; TLR = considerable length reduction of tooth; TED = large areas of exposed, soft dentin; VLR = marked length reduction of tooth; and VCA = pain on chewing.

relation to age groups is therefore presented for the whole material in Table 3. The percentage of unworn teeth decreased from 13.2 to 0 with age, whereas the percentage of teeth in group S remained relatively constant at a high level between approximately 80 and 90, except in the oldest age group, in which it was reduced to about 60%. The percentage of teeth in group M increased more or less linearly from the youngest age group up to age group 70–79 years, but in the last one it was almost twice as high. No teeth were assigned to categories T or V up to the age of 39 years. In the other groups the percentage of teeth in these categories was small, reaching a peak of 3.4% for category V in the oldest age group.

Fig. 3 illustrates the percentage distribution of each subcategory of wear for the material as a whole. Definitions are presented in the legend to the figure.

The percentage rate of wear of the subcategories small areas of exposed dentin (SDF), obvious length reduction of tooth (MLR), large areas of exposed, hard dentin (MED), MWR, and MED-P combined for groups of teeth—that is, incisors, canines, premolars, and molars of both jaws—is presented in Fig. 4. Incisors and canines were more worn than premolars and molars.

When subcategories of wear were evaluated in relation to age groups, it was not until age group 50–59 years that subcategory SDF and more serious ratings dominated over subcategory wear facets in enamel (SOF). Upper and lower front teeth—that is, incisors and canines—were the first teeth to be given the rating SDF or worse, and this occurred already in the age group 20–29 years. The percentage was 20.

Discussion

The inter-examiner agreement for main categories of wear was acceptable on the first occasion (average, 13.2%) and excellent on the second (average, 4.0%), the reason probably being that all examiners had practiced the system by scoring their own patients in the period between. With some practice, therefore, the rating system should be well

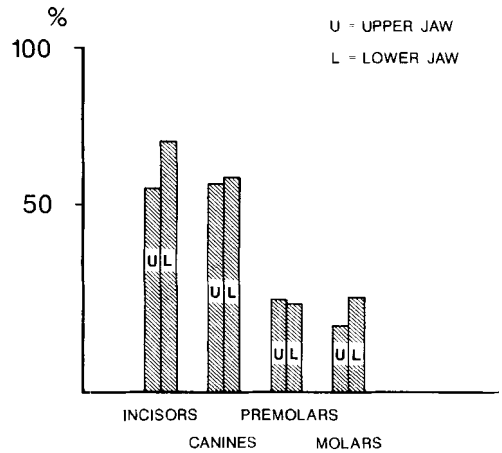

Fig. 4. Percentage distribution of teeth in the following subcategories: small areas of exposed dentin; obvious length reduction of tooth; large areas of exposed, hard dentin; large wear facets in enamel; and perforation of crown with hard, non-sensitive dentin exposed, combined for groups of teeth: incisors, canines, premolars, and molars.

suitable for the recording of the main groups of wear and thus making it possible to decide when treatment is necessary from a dental point of view. With regard to the subcategories, however, the inter-examiner reliability was not so good—21.9% on an average the first time and 16.8% the second. This may indicate that a better job of calibration should be done when subcategories must be used in the screening of dental wear in large populations.

The material is hardly representative of a normal population. The finding that almost the same number of teeth was missing in both jaws is most remarkable. The percentage of missing teeth was only 18.5, whereas the percentage of teeth with unrestored incisal/occlusal surfaces was as high as 44. All these findings are indicative that these patients have been much concerned about their dental health, seeking regular care whenever necessary and possible.

The introduction of two extra subgroups (MWR and MED-P) in category M was a consequence of experience from previous studies (6, 7) to overcome the problem of rating wear of restorations. It should be easy to accept that large wear facets in restorative material do not need irreversible treatment and can therefore be classified under category M. To accept that perforations of crown material belong to the same category may perhaps be more difficult. However, in our opinion there is no absolute need for replacement of a perforated crown or for any other irreversible kind of treatment as long as the dentin exposed is hard and no caries can be detected.

From Table 2 it is apparent that amalgam is the main restorative material used, except in the oldest age group, in which gold restorations predominated. Otherwise it may be pointed out that for all age groups up to 59 years more ceramic than gold restorations had been made. In age group 60–69 years these percentages were equal, whereas in the two oldest age groups gold was most abundant, reflecting no doubt the increased use of metal ceramic as compared with gold crowns during the past 20–25 years.

Both Figs. 2 and 3 and Table 3 demonstrate that most teeth, irrespective of age, display modest wear—that is, category Sierra. This probably reflects the non-abrasive foods commonly used today and a clientele not having excessive bruxism or being exposed to abrasives or chemicals in their work environments (5, 3). In a previous report (6) on mentally retarded people, some of whom showed signs of severe bruxism, there were twice as many teeth belonging to category M in age group 30–39 years and four and a half times as many in age group 40–49 years as in the present material.

The fact that only 0.6% of the teeth in this material were rated as in need of treatment seems natural when considering that these patients were regular seekers of dental treatment. In most cases the dentist had no doubt suggested and carried out the treatment before the teeth had reached categories T or V.

The observation that the front teeth showed more wear than the premolars and the molars (Fig. 4) is in agreement with previous reports (5, 10, 11) using other methods of wear rating. However, the fact that the lower incisors apparently were more worn than upper ones in this study may have

a special reason. The upper ones may for esthetic and not purely odontologic reasons have been capped at an earlier stage and the restorative material may have been rated as R or SOF, whereas the antagonizing lower teeth have received a different score, reflecting the wear of the tooth substance as such. That this supposition is correct is verified by the fact that 18% of the upper incisors and only 11% of the lower ones had been capped.

In this material wear through the enamel—that is, wear rating SDF or worse—did not dominate the picture until the fifth decade and later. Still, wear category M was recorded already in the youngest age group, and the first teeth to be given this score were lower incisors and, to a smaller extent, upper canines. This is in accordance with a previous study of 19-year-old individuals (8).

In conclusion, it may be stated that this index for rating dental wear is relatively easy to use and will in practice no doubt also be suitable when scoring subcategories of wear in larger populations. Moreover, in a Norwegian urban population with normal dental care, tooth wear is apparently a relatively small problem even though wear through the enamel can be found already at an early age.

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