Prevalence, pattern, and severity of incisal wear in dental students

John Silness, Morten Berge and Gerd Johannessen
Department of Prosthodontics, School of Dentistry, University of Bergen, Bergen, Norway

Silness J, Berge M, Johannessen G. Prevalence, pattern, and severity of incisal wear in dental students. Acta Odontol Scand 1994;52:178–181. Oslo. ISSN 0001-6357.

This paper describes the prevalence, pattern, and severity of incisal wear of anterior teeth in 64 dental students at an average age of 23 ± 1.7 years with a high number of permanent teeth present. The index used to assess wear on stone casts (IwI) was shown to have good reproducibility. The results indicated that about 98% of the anterior teeth had been worn to various degrees. In both jaws central incisors were most commonly affected by incisal wear, canines followed next in order, and lateral incisors were least commonly affected. Wear of identical teeth on the right and left side tended to be bilaterally symmetrical in both jaws. The results of these initial observations suggest that data from re-examination of this study group will lend themselves to detecting possible changes of the pattern and severity of incisal wear of permanent anterior teeth. □ *Anterior teeth; dental students; incisal wear; tooth wear*

John Silness, Department of Prosthodontics, School of Dentistry, University of Bergen, Årstadveien 17, N-5009 Bergen, Norway

Many and various aspects of occlusal and incisal tooth wear have been dealt with in a considerable number of publications related to the epidemiology of tooth wear (1–11). Indications are that tooth wear starts at an early age and increases in prevalence and severity with increasing age, that the number of teeth influences wear, and that some population groups may have more severe wear than others. Further, it is generally agreed that the loss of tooth substance is gradual, but little is known about the rate of progression of tooth wear. Most of our information about tooth wear has been derived from cross-sectional studies, whereas longitudinal studies are rare (3, 4, 8, 11, 12). Clearly, a better insight into the development of the pattern and severity of tooth wear may be obtained through longitudinal investigations, which would enable observation of changes over time. The material presented in this paper is based on an examination of dental students with a large number of permanent teeth present. The purpose of this report was to concentrate on describing the prevalence, pattern, and severity of incisal wear in this population on the basis of cross-sectional data, which may form the basis for comparison with future re-examination information after 2, 4, and 6 years.

Materials and methods

The study group consisted of 64 dental students (25 men, 39 women). They constituted all the Norwegian students in their 3rd, 4th, and 5th academic year at the School of Dentistry, University of Bergen, Norway. The mean age in 1991 was 23 ± 1.7 years. The group had an average of 28 ± 1.57 teeth, including 65 erupted third molars—28 in the upper jaw and 37 in the lower. Twenty-six premolars had been removed on orthodontic indications. Two lateral incisors, one in the upper jaw and one in the lower jaw, were missing (agenesis). One maxillary central incisor had received an artificial crown in connection with trauma. Hence, 382 maxillary anterior teeth and 383 mandibular anterior teeth were examined.

Upper and lower jaw dental stone casts (Vel-Mix) were obtained, using stock trays.

Table 1. Criteria for the incisal wear index (IwI) system

0 = Developmental incisal notches (the mamelones) present
1 = Developmental incisal notches disappeared
2 = Clearly outlined smooth incisal wear facets
3 = Loss of substance with excavation along the incisal edge ('ditching')

Silicone-based impression material (Xantopren, L and H) was used together with adhesive (Bayer Universal Adhesive) applied in thin layers in the trays.

Assessment of incisal tooth wear of the six anterior maxillary and mandibular teeth was made on the stone casts in accordance with the incisal wear index (IwI) (Table 1) used by Silness et al. (11). The stone casts were evaluated twice by each of the two examiners, A and B, to measure concordance between the assessments. The kappa statistic (13, 14) was used to measure reproducibility between examinations for each of the examiners. For examiner A the kappa statistic was 0.88 for maxillary teeth and 0.89 for mandibular teeth. For examiner B the kappa statistic was 0.70 and 0.78, respectively. These values denote 'excellent' to 'good' reproducibility (13). Final assessment of wear was made side-by-side by the two examiners. The results of the final assessments were used for the present report.

For the analysis of the pattern and severity of incisal tooth wear, means and standard deviations of the IwI scores for the various morphologic tooth types were calculated. Distributional differences were tested using chi-square tests. A significance level of 5% was used for rejection of the null hypothesis.

Results

Of a total of 765 anterior teeth, 13 teeth scored IwI = 0 and affected 5 students. The mean IwI of the six maxillary anterior teeth varied between 1.84 and 2.29. Central incisors showed the highest mean values and lateral incisors the lowest values. Canines had mean values between those of central and lateral incisors (Table 2). The six mandibular anterior teeth displayed mean IwI values varying between 1.95 and 2.17. Central incisors had the highest means and lateral incisors the lowest, whereas canines had mean values in between. Chi-square tests showed that the distribution of IwI scores for the various maxillary tooth types (Fig. 1) differed statistically (chi-square = 71.98, df 4, $p < 0.0001$). Central incisors (11 + 21) had the highest percentage of IwI = 3 scores and a relatively low percentage of IwI = 1 scores. Lateral incisors (12 + 22) showed the lowest percentage of IwI = 3 scores and the highest percentage of IwI = 1 scores. Canines had a frequency of IwI = 3 scores between those of the incisors and the lowest percentage of IwI = 0 + 1 scores. Chi-square tests for the lower jaw teeth showed that the distributional differences (Fig. 2) were statistically significant (chi-square = 65.17, df 4, $p < 0.0001$). Central incisors (31 + 41) showed the highest frequencies of IwI = 3 scores and the lowest frequency of IwI = 2 scores. Lateral incisors (32 + 42) had the highest frequency of IwI = 0 + 1 scores and a low frequency of IwI = 3 scores. Canines (33 + 43) showed the highest percentage of IwI = 2 scores and the lowest percentage of IwI = 0 + 1 scores. Comparison of the upper and lower jaw showed

Table 2. Mean scores ($\bar{x}$) and standard deviations (SD) for incisal tooth wear (IwI) of the various anterior teeth in Norwegian dental students in 1991

		Incisal wear index	
Tooth	*n*	$\bar{x}$	SD
13	64	2.29	0.58
12	64	1.84	0.69
11	64	2.42	0.61
21	63	2.44	0.61
22	63	1.87	0.72
23	64	2.20	0.50
43	64	2.17	0.48
42	64	1.95	0.74
41	63	2.46	0.75
31	64	2.42	0.79
32	64	1.95	0.74
33	64	2.04	0.57

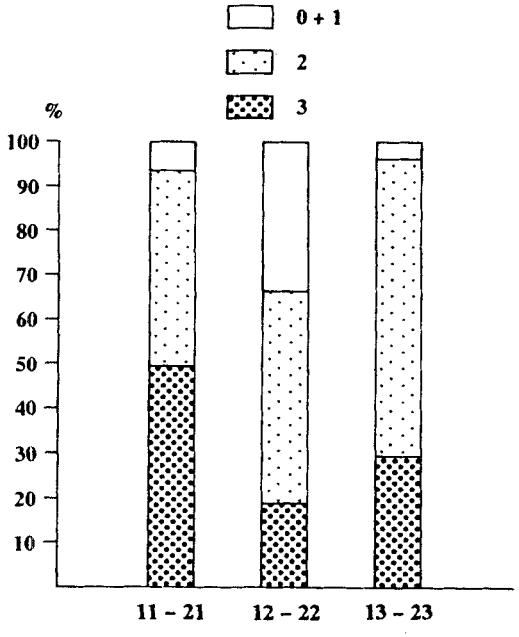

Fig. 1. Frequency distribution of percentage incisal wear index (IwI) scores for the various maxillary tooth types.

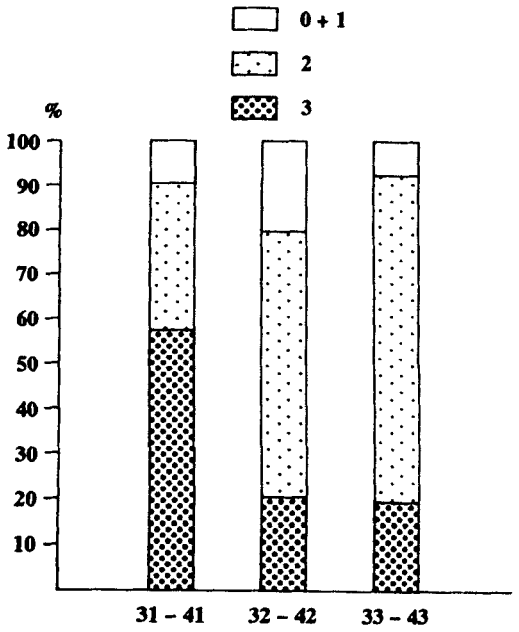

Fig. 2. Frequency distribution of percentage incisal wear index (IwI) scores for the various mandibular tooth types.

that the distributional differences in the IwI scores were not statistically significant (chi-square = 0.64, df 2, $p = 0.72$). IwI = 3 scores made up ~12% in both jaws, IwI = 2 scores about 53–55%, and IwI = 0 + 1 scores accounted for around 13–14%. In all, 13 teeth (1.6%) scored IwI = 0. Distributional differences between identical teeth of the right and left side of the arches were tested by chi-square tests. The results showed that the differences were not statistically significant for any of the six pairs examined ($p > 0.05$). The highest chi-square value was obtained for the comparison between 33 and 43 (chi-square = 1.96 df 2, $p = 0.37$).

Discussion

Incisal tooth wear was evaluated by the criteria of the IwI system, which was recently used to assess wear of central incisors in individuals 15 and 27 years old and was shown to have good reproducibility as measured with the kappa statistic (11). The results of the present study proved that the reproducibility, as measured by the same statistic, was good also when applied to all anterior teeth in individuals 23 ± 1.7 years old. The present cross-sectional data have shown that about 98% of the anterior teeth in dental students demonstrated incisal wear as assessed by the index used. This is a higher frequency than reported for corresponding age groups in earlier work (for example, Refs. 5, 6). Comparison is difficult because the examinées of the samples and the criteria used to describe wear differed. On the basis of a study using the IwI system it was reported that in individuals 27 years old the mean values of central incisors amounted to IwI ~2.30 (11), as against IwI ~2.40 in the present study. The present results show that wear of the upper and lower jaws does not differ statistically. This finding in students compares with the longitudinal observation that wear differences between upper and lower jaw central incisors in adolescents had been leveled out in 27-years-olds (11).

The design of the present study enabled comparison of the frequency distribution of severity scores of the various tooth types. In both jaws the severity of wear for the various tooth types differed from each other. In both the upper and lower jaws central incisors showed the most advanced wear, the canine teeth ranked second, and lateral incisors demonstrated the least wear. Apparently, wear of the anterior tooth types after clinical eruption proceeds at different rates in both jaws. For example, lateral incisors, which erupt clinically (approximately at the age of 8 years) about 1 year after central incisors (15), did not reach the IwI level of central incisors after 15 years in the mouth—at the age of 23 years. Further, wear of canine teeth, which erupt clinically approximately 2–3 years after the lateral incisors, exceeded the IwI levels of lateral incisors before the age of 23 years. At the same time identical teeth on the right and left sides of the jaws had reached about equal IwI levels and did not differ statistically. This confirmed the clinical impression that incisal wear is symmetrical in anterior permanent teeth in individuals with virtually complete dentitions.

In general, the results of these examinations show that all stages of incisal wear as described in the IwI system are present in this convenience sample. Clinical experience indicates that more severe incisal wear than that described by IwI = 3 occurs. To describe longitudinally the development of incisal wear, a score of IwI = 4 for a stage with more advanced excavation forming concave cavities surrounded by an enamel rim may be required for anterior teeth.

These initial studies and their results together with the positive and cooperative attitude of the students suggest that we should have the possibility in future studies to detect changes in the pattern and severity of incisal wear of anterior teeth.

Received for publication 29 September 1993
Accepted 30 November 1993

References

1. Pindborg JJ. Pathology of the dental hard tissues. Copenhagen: Munksgaard, 1970.
2. Krogh-Poulsen W. Abrasion og migration. In: Krogh-Poulsen W, Carlsen O, editors. Orthofunktion, bidtfunktion/bettfysiologi. 2nd ed. Copenhagen: Munksgaard, 1977:189–204.
3. Molnar S, McKee JK, Molnar IM, Przybeck TR. Tooth wear rates among contemporary Australian aborigines. J Dent Res 1983;62:562–5.
4. Carlsson GE, Johansson A, Lundqvist S. Occlusal wear. A follow-up study of 18 subjects with extensively worn dentitions. Acta Odontol Scand 1985; 43:83–90.
5. Hugoson A, Bergendal T, Ekfeldt A, Helkimo M. Prevalence and severity of incisal and occlusal tooth wear in an adult Swedish population. Acta Odontol Scand 1988;46:255–65.
6. Dahl BL, Øilo G, Andersen A, Bruaset O. The suitability of a new index for the evaluation of dental wear. Acta Odontol Scand 1989;47:205–10.
7. Ekfeldt A, Hugoson A, Bergendal T, Helkimo M. An individual tooth wear index and an analysis of factors correlated to incisal and occlusal wear in an adult Swedish population. Acta Odontol Scand 1990;48:343–9.
8. Nyström M, Könönen M, Alaluuusa S, Evälahti M, Vartiovaara J. Development of horizontal tooth wear in maxillary anterior teeth from five to 18 years of age. J Dent Res 1990;69:1765–70.
9. Crothers AJR. Tooth wear and facial morphology. J Dent 1992;20:333–41.
10. Johansson A. A cross-cultural study of occlusal tooth wear. Swed Dent J 1992 Suppl 86.
11. Silness J, Johannessen G, Røynstrand T. Longitudinal relationship between incisal occlusion and incisal tooth wear. Acta Odontol Scand 1993;31:15–21.
12. Johansson A, Haraldson T, Omar R, Kiliaridis S, Carlsson GE. A system for assessing the severity and progression of occlusal tooth wear. J Oral Rehabil 1993;20:125–31.
13. Landis JR, Koch GG. The measurement of observer agreement for categorical data. Biometrics 1977;33: 159–74.
14. Rosner B. Fundamentals of biostatistics. 2nd ed. Boston: PWS Publishers, 1986.
15. Haavikko K. The formation and the alveolar and clinical eruption of the permanent teeth. An orthopantomographic study. Proc Finn Dent Soc 1970; 66:103–70.