Prevalence of occlusal tooth wear and its relationship to lateral and protrusive contact schemes in a young adult Indian population

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The aim of the present study was to investigate the prevalence and severity of occlusal tooth wear and their interrelationships with lateral and protrusive occlusal contact schemes in a young adult Indian population. The material comprised 64 individuals (age: $\bar{x} = 19$ years; range, 17–24 years). Assessment of wear was performed by means of a tooth-by-tooth evaluation of casts. Lateral excursive and protrusive contact relationships were recorded at the clinical examination. There was no difference in the degree of wear between women and men. Mean occlusal wear was low for the population studied compared with similarly aged Scandinavians and Saudis. No differences in the severity of wear were found in relation to lateral excursive and protrusive contact schemes. Whereas the low wear experience in the present Indian sample may be related to dietary factors, more must be understood about the various other causes of occlusal tooth wear before its functional interdependence becomes clear. □ *Dental occlusion; epidemiology; tooth abrasion; tooth attrition*

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Even though epidemiologic data reveal relatively low prevalences of extensive wear in Western communities (1), the subject of occlusal wear has sustained considerable interest in the dental literature in recent years. Hugoson et al. (2), in their epidemiologic study of randomly selected Swedes, reported a low prevalence of extensive wear; Seligman et al. (3) and Egermark-Eriksson et al. (4) confirmed similarly low frequencies in more selected samples. In contrast, present generations of Eskimos and Australian aborigines, while showing predictably reduced wear as a result of the transition from rural to urban environments (which is accompanied by a transition to a more refined diet and the discontinuation of using 'teeth as tools'), nevertheless still experience a degree of wear which greatly exceeds that found in their Western counterparts (5, 6).

The etiology of advanced tooth wear in contemporary populations is complex, and its multifactorial character is well documented (7). Factors that have been shown to be associated with wear include functional or parafunctional habits, patterns of mandibular movement, diet, diseases, saliva, bite force, craniofacial morphology, habitat, and occupational environments (8–13).

Functional occlusal contact relationships customarily follow one of two philosophies. Canine guidance, according to D'Amico (14), is characterized by a vertical masticatory pattern by virtue of the canines limiting the horizontal component of mandibular movement; tooth wear is purportedly prevented or minimized. In contrast, group function, as defined by Schuyler (15), possesses contact on several teeth in lateral excursive and protrusive mandibular movements; the accompanying occlusal wear is,

according to its proponents, regarded as physiologic and advantageous (15).

Whereas certain hypotheses are broadly adhered to by some clinicians, controversies remain as to the exact nature of the interrelationship between occlusal contact schemes and wear (16). Similarly, if wear is a physiologic mechanism, the extent to which it must exist for it to be regarded as such is still debated (17). The point at which restorative intervention becomes necessary is equally unclear, as is the clinician's prescription of an occlusal scheme in such cases. Furthermore, as a result of the retention of natural teeth into old age (18), it is likely that both the problems caused by occlusal wear and management challenges will continue in the future.

The Republic of India occupies most of the Indian subcontinent, and its size corresponds to one-third of that of the United States. In 1991, the population was 866 million (19), which represents the second most populous nation after China. The state of Tamilnadu, and its capital Madras, with 5.3 million inhabitants (19), is located on the southeast coast of India and experiences a perennial tropical climate. The state has, in recent years, undergone rapid development, including a shift from largely rural to urban lifestyles. To our knowledge, reports on tooth wear in contemporary Indians are lacking. It was the purpose of this study, therefore, to perform a cross-sectional investigation of the prevalence and severity of occlusal wear and its correlation, if any, with excursive contact schemes in a young adult Indian population living in Madras, India.

Materials and methods

The sample comprised 64 individuals (age: $\bar{x} = 19$ years; range, 17–24). Thirty-four were men ($\bar{x} = 19$ years; range, 17–24 years) and 30 were women ($\bar{x} = 19$ years; range, 18–21 years). The individuals constituted two complete classes of second-year undergraduate dental students at Saveetha Dental College, Madras, India.

A set of maxillary and mandibular study casts was obtained for each individual, using standard alginate impressions in perforated metal stock trays. The impressions were poured in vacuum-mixed diestone (or, occasionally, in good-quality dental stone). Only casts permitting accurate scoring of wear were accepted.

Table 1. Ordinal scale used for grading severity of occlusal wear

0 = No visible facets in the enamel. Occlusal/incisal morphology intact.
1 = Marked wear facets in the enamel. Occlusal/incisal morphology altered.
2 = Wear into the dentin. Dentin exposed occlusally/incisally and/or adjacent tooth surface. Occlusal/incisal morphology changed in shape with height reduction of the tooth.
3 = Extensive wear into the dentin. Larger dentin area (>2 mm^2) exposed occlusally/incisally and/or adjacent tooth surface. Occlusal/incisal morphology totally lost locally or generally. Substantial loss of crown height.

Evaluations of the severity of wear were performed by two independent examiners (A. Abdullah, H. Sherfudhin), on the study casts, and on a tooth-by-tooth basis using an ordinal scale (Table 1). The evaluations were made after a period of training and calibration with a third examiner (A. Johansson), to conform to a previously described method (13). Wear scores were reduced to indices for statistical purposes.

Intra- and inter-examiner concordances were tested, first, by each examiner performing two successive blind assessments on each of 280 teeth on 10 casts on a randomly selected and ordered basis, and, secondly, by each examiner independently scoring all of the 64 pairs of casts. After calculation of interexaminer concordance, any dissimilarities in scores were re-evaluated, with a final score mutually reached by the examiners.

After a period of training and calibration in the clinical technique, each subject was examined in a standard fashion; after each had been instructed in and practiced left and right lateral excursive movements to the buccal cusp-to-cusp position and protrusive movement to the incisal edge-to-edge position, the examiner recorded the contact

Table 2. Definitions of lateral excursive occlusal contact schemes

Bilateral anterior guidance = Canine guidance only, or in combination with incisor contact.
Bilateral group function = Two or more posterior (premolars and/or molars) teeth in contact, but canine contact was permitted in combination with the posterior teeth.
Mixed = Anterior guidance on one side in combination with group function on the opposite side.

Table 3. Definitions of protrusive contact schemes

Anterior guidance = Anterior teeth (canines and/or incisors) in contact only.
Posterior guidance = Posterior teeth (premolars and/or molars) in contact only.
Combined guidance = Anterior as well as posterior teeth in contact.

relationships. All movements were initiated from the intercuspal position and the lateral excursive and protrusive contact schemes were categorized for each subject (Tables 2 and 3). Results were recorded on standardized charts.

Statistical methods

All statistical analyses were performed on an IBM Personal Computer using the Statistical Package for Social Sciences (SPSS, Release 5). The gender differences in wear indices and in occlusal schemes were tested by means of the independent-samples Student *t* test. Differences between wear indices were tested using the paired Student *t* test. Kruskal–Wallis one-way analysis of variance was used when testing the wear experiences within defined occlusal schemes. Intra- and inter-examiner concordances were determined by the percentage correlation between examiners.

Results

The sample comprised a total of 1791 teeth, and the median number of teeth was 28 per individual (third molars excluded); only 1 tooth was missing in the sample, and restorations of any kind were negligible. On the basis of Angle's classification 58 subjects (91%) were assigned to class I, 6 (9%) to class II, and none to class III. In the evaluation of occlusal wear, interobserver concordance was 92%, whereas intraobserver concordance was 88% for both examiners.

Comparison of gender differences in wear variables and lateral and protrusive schemes showed no statistically significant differences; subsequent statistical management was therefore performed on the total group.

The median wear score for all teeth and for all tooth groups was 1, equal to 'marked wear facets in the enamel', with a range of 0–2; 244 teeth (14%) were graded as 0, 1345 (75%) as 1, and 202 (11%) as 2. Generally, anterior teeth showed higher wear grades than did posteriors, as reflected in the higher frequency of grade 2, corresponding to 'wear into the dentin' in anterior teeth (Fig. 1).

The mean dentition wear index and the subindices, derived from anterior, posterior, and canine tooth groups, and individual arches, are shown in Table 4. The mean dentition wear index was 0.99, and the highest dentition index found in the sample was 1.57. Statistical comparison of the anterior and posterior subindices showed a significantly higher value for the former ($p < 0.001$). The canine subindex was also significantly higher than the posterior one ($p < 0.001$). No statistically significant difference was found between the maxillary and mandibular subindices.

Of the defined lateral excursive schemes, 78% possessed anterior guidance, 17% group function, and 5% mixed guidance; of the 50 individuals with anterior guidance, 30 (47% of the total sample) had bilateral canine guidance, and the other 20 individuals had a unilateral canine guidance with a contralateral incisal guidance. In protrusion, 86% had anterior guidance, 8% posterior guidance, and 6% combined guidance.

When the mean wear indices and subindices within the various lateral excursive and protrusive scheme categories were compared, no statistically significant differences

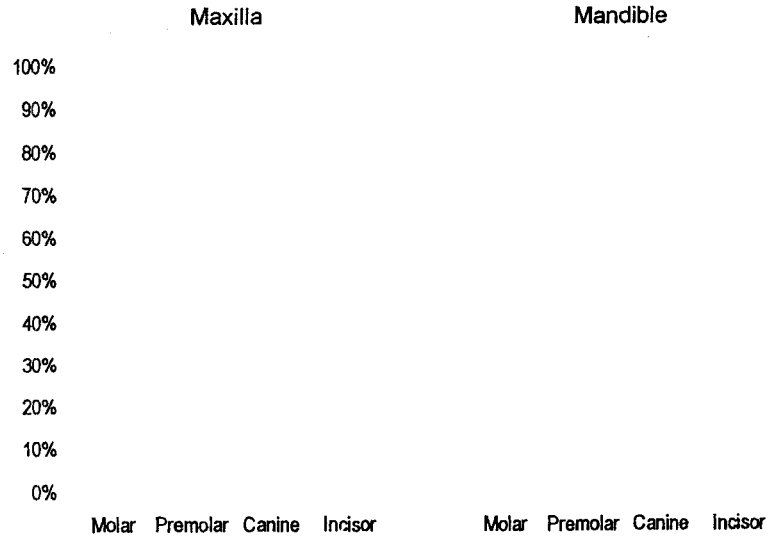

Fig. 1. Percentage distribution of maxillary and mandibular wear scores within the sample (n = 1791 teeth).

were found, although the group function and mixed guidance schemes and the posterior guidance and combined guidance schemes showed slightly higher index values than the anterior guidance scheme in both lateral excursive and protrusive movements (Table 5).

Discussion

The wear grading system applied in this study was identical to that used in previous reports (20, 21). Inter- and intra-observer concordances of 92% and 88%, respectively, also conform to those in the aforementioned studies and suggest good reliability. Similarly, the rationale for transforming the wear scores into a mean dentition index and segmental subindices has been addressed in a previous paper, with the conclusion drawn that the advantages of using mean indices outweighed their supposed disadvantages (13).

In a prevalence study of occlusal wear in Saudi dental students (20), using a wear grading system identical to that applied in the present study, the mean dentition wear index was 1.48, which is considerably higher than the mean of 0.99 found in the present Indian dental students. In addition, none of the individuals in the present study scored above 2 ('wear into the dentin'), whereas in the Saudis a score of 3 ('extensive wear into the dentin') was not an uncommon finding.

Dahl et al. (22), in their study of ortho-

Table 4. Means ($\bar{x}$), standard deviations (SD), and ranges (R) of the dentition index and the anterior, posterior, canine, and arch subindices within the sample (n = 64)

	Indices					
	Dentition	Anterior	Posterior	Canine	Maxilla	Mandible
$\bar{x}$	0.99	1.16	0.86	1.13	0.96	0.99
SD	0.21	0.33	0.20	0.34	0.20	0.24
R	0.61–1.57	0.58–2.17	0.50–1.31	0.00–2.00	0.50–1.57	0.64–1.57

Table 5. Mean occlusal wear indices and subindices within defined lateral excursive and protrusive contact scheme categories in 64 individuals

	Indices			
	Dentition	Anterior	Posterior	Canine
Lateral excursion				
Anterior guidance ($n = 50$)	0.96	1.12	0.84	1.11
Group function ($n = 11$)	1.09	1.33	0.92	1.16
Mixed ($n = 3$)	1.07	1.28	0.92	1.25
Protrusion				
Anterior guidance ($n = 55$)	0.97	1.15	0.84	1.10
Posterior guidance ($n = 5$)	1.11	1.20	1.04	1.30
Combined guidance ($n = 4$)	1.08	1.29	0.92	1.25

dontically untreated 19-year-old Norwegians, using a clinical assessment of wear, found that 4% of the teeth of the individuals had 'no visible wear', and that 6% of the teeth showed 'wear into dentin'. Whereas the frequency of 'wear into dentin' was higher in the present Indian sample (11%), the substantially higher frequency of 'no visible wear' (14%) recorded in the Indians is noteworthy.

Although it is obvious that the wear experience of Saudis was higher than that found in Norwegians, the latter group, in turn, seems to have more severe wear than the Indians, at least as might be inferred from the frequency of score 0. In the Saudi population it is likely that the presence of fine ambient sand particles, due to the harsh desert terrain, constitutes an important etiologic factor for wear (13). In the Norwegians, however, no obvious environmental factor has been identified, and the minimal wear experienced by Western populations could, to some extent, be ascribed to the reduced functional demands, following a transition to a refined and non-abrasive diet over the past centuries (23).

With regard to dietary habits and occlusal wear in Indians, the ingredients in traditional South Indian cooking constitute mostly vegetables, rice, pulses, with a small intake of meat. Food is generally overcooked and is, therefore, soft in consistency. The method of ingestion is also noteworthy: before intake, the food is clumped into a 'ball', using the fingers. In this manner, the food is hardly chewed, and swallowing is commonly accomplished with a 'gulp'. Consequently, it may be speculated that the Indian method of food preparation and technique of eating are significant factors in minimizing the functional wear generated during chewing. This may, at least partly, explain the lower wear experience in Indians compared with similarly aged Norwegians.

The distribution of the types of lateral and protrusive occlusal schemes conformed broadly with that reported elsewhere (24). No correlation between the type of lateral excursive or protrusive contact relationship and the severity and location of wear was found. This is in disagreement with the findings in previous reports conducted in a Swedish and a Saudi population, using similar methods for categorizing occlusal schemes, in which studies certain significant correlations between occlusal scheme and wear were found (25, 26). However, both of these populations constituted individuals exposed to prevalent wear-conducive factors that resulted in a high degree of wear; the possibility that a 'wearing-in' process prevails in such subjects should be expected and considered a normal physiologic mechanism (13, 17, 27).

The findings that young adults possess canine guidance more frequently than group function (24) and experience only mild occlusal wear (2, 3) (which was also the case in the present study) need not necessarily imply a dependence of mild wear on the presence of canine guidance; it may simply

be due to an absence of causative factors in such individuals, preventing the wearing-in process, which, in turn, is a prerequisite for wear–contact relationships to be found. The contention that the type of occlusal scheme is not a determinant for developing wear is supported by the results of a recent 1-year longitudinal report comparing the wear of bruxers and non-bruxers with occlusal scheme: in that study no differences in enamel wear were found with regard to either bruxism or occlusal scheme (28). In addition, the cited report (28) further supports the suggestion that bruxism may have been overestimated as a causative factor in tooth wear; other etiologic influences may be potentially more powerful (13).

Consequently, the present and previous (25, 26) findings question the capacity of either 'disclusive protection' or 'mutual protection' to prevent wear and of group function to permit controlled wear; much more needs to be understood about the many causes of occlusal tooth wear, and their interrelationships, before its functional interdependence becomes clear.

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