Tooth attrition patterns in a group of Iraqi adults sample with different classes of malocclusion (A comparative study)

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ABSTRACT

Background: Tooth attrition is wearing away of tooth structure during mastication. This study investigated tooth wear patterns in adults with different classes of malocclusion and compared them with normal occlusion.

Materials and methods: The sample consisted of 363 subjects that were divided into 5 groups with an age range "18-25" years: 85 normal occlusion, 128 class I with crowding, 90 class II division 1, 30 class II division 2 and 30 class III. Dental wear was assessed by using a modified version of the tooth wear index.

Results:

1. The class I malocclusion group had statistically greater tooth wear in incisal surfaces of maxillary central and lateral incisors, and mandibular lateral incisors than did the normal occlusion.

2. The class II division 1 group had statistically greater tooth wear in the occlusal surfaces of maxillary second premolars, mandibular first and second premolars. Buccal surfaces of mandibular canines, mandibular second premolars and mandibular first molars than did the normal occlusion.

3. The class II division 2 malocclusion group had statistically greater tooth wear in labial surfaces of mandibular central and lateral incisors. Buccal surfaces of mandibular second premolars, mandibular first molars. Occlusal surfaces of maxillary first and second premolars and mandibular second premolars than did normal occlusion.

4. The class III malocclusion group had statistically greater tooth wear in the occlusal surfaces of maxillary first and second premolars than did normal occlusion.

Conclusion: In conclusion subjects with normal occlusion and those with different classes of malocclusions have different tooth wear patterns.

Keywords: attrition, wear patterns, modified tooth wear index. (J Bagh Coll Dentistry 2012;24(2):114-119).

INTRODUCTION

Due to the decreasing occurrence of dental caries in many societies, increasing attention has focused on tooth wear from erosion, abrasion and attrition [1]. Tooth wear is a normal physiologic process that occurs through a variety of mechanisms and increases with age. It can be defined as the noncarious loss of tooth substance as a result of the combined processes of erosion, attrition, and abrasion; these terms reflect specific etiologic factors [2]. Gradual attrition of the occlusal surfaces of the teeth appears to be a general physiologic phenomenon in all mammals, in every civilization, and at all ages. Tooth wear has characteristic features that must be distinguished from abrasion and erosion and characterized as flat, sharply or round angled and polished surfaces and may come from excessive attrition of one tooth against the other [3] .Smith and Knight [4] introduced the tooth wear index (TWI), which attempted to provide a solution to some problems associated with measuring wear at the individual and community levels. The TWI and modified versions of it have been used in many studies; this suggests widespread acceptance [5-7]. However, it was described as flawed when used in an aging population, because it does not take into account teeth that were restored due to wear [8]. The modifications matched the World Health Organization standards, thus allowing application of the index in broad epidemiologic surveys for both of deciduous and permanent dentitions [9]. Some studies indicate that masticatory forces and malocclusion are primary etiologic factors for noncarious lesion development [10-14], although other authors did not find this correlation [15-18]. Because of the high prevalence of malocclusions as well as the controversies in the studies of tooth wear, it is relevant to verify the pattern of tooth wear of various occlusal relationships to help professionals to differentiate between physiologic and pathologic processes.

MATERIALS AND METHODS

The sample has been selected randomly from the students of Babylon university (college of medicine, college of dentistry and college of nursing) and some patients were selected randomly from the patients attended the orthodontic department and oral medicine department of dentistry college of Babylon University. Out of 440 persons only 363 subjects were selected (18-25 years old) and divided into five groups:

1. Group one included 85 subjects with normal occlusion (45 males and 40 females).

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2. Group two included 128 subjects with class I malocclusion with crowding (63 males and 65 females).

3. Group three included 90 subjects with class II division 1 malocclusion (35 males and 55 females).

4. Group four included 30 subjects with class II division 2 malocclusion (12 males and 18 females).

5. Croup five included 30 subjects with class III malocclusion (14 males and 16 females).

The sample was taken in terms of the following criteria:-

1. The sample was all of Iraqi Arab in origin.
2. No previous orthodontic treatment.
3. No extracted teeth up to the first molar.
4. No openbite.
5. No parafunctional habits.
6. No temporomandibular joint problems.

The surfaces of all teeth in the mouth were scored according to tooth wear index by Smith and Knight [4] modified by Sales Peres *et al.*[7]. The modifications matched the World Health Organization standards [9], thus allowing application of the index in broad epidemiologic surveys for both of deciduous and permanent dentitions. The modifications made calibration easier because the modified tooth wear index does not differentiate the depth of dentin involvement, as does the original tooth wear index.

In addition, the modified version includes a code for teeth that have been restored due to wear (code 4) and another code for teeth that cannot be assessed (code 9); the amount of permanent tooth wear is scored by numbers (Table 1). Each 2 groups were compared using **Mann Whitney** test for the frequency and severity of wear on each surface of each group of teeth.

RESULTS

In total, 17424 dental surfaces were evaluated. Of these, 64.2 % had no dental wear (score 0), 33.8% had incipient lesions (score 1), 1.3 % had moderate lesions (score 2) and 0.7% were excluded (score 9).No severe lesions were found.

1. Class I (crowding):
The class I malocclusion group had statistically greater tooth wear in incisal surfaces of maxillary central incisors, incisal surfaces of maxillary lateral Incisors and incisal surfaces of mandibular lateral incisors (table 2) than did the normal occlusion.

The normal occlusion group had statistically greater tooth wear in the incisal surfaces of maxillary canines and Buccal surfaces of mandibular first (tables 2), than did the class I malocclusion (crowding).

2. Class II division 1:
The normal occlusion group had statistically greater tooth wear in the incisal surface of maxillary lateral incisors incisal surface of mandibular central incisors and incisal surface of maxillary canine than did the class II division 1 malocclusion group, (table 3). The class II division 1 group had statically greater tooth wear in the occlusal surfaces of maxillary second premolars, occlusal surfaces of mandibular first premolars , occlusal surfaces of mandibular second premolars (table 3), labial surfaces of mandibular canines, buccal surfaces of mandibular second premolars and buccal surfaces of mandibular first molars than did the normal occlusion group, (table 3)

3. Class II division 2:
The normal occlusion group had statistically greater tooth wear in the incisal surface of maxillary lateral   and incisal surfaces of maxillary canines than did class II division 2 group, (table 4). The class II division 2 malocclusion group had statically greater tooth wear in labial surfaces of mandibular central incisors, labial surfaces of mandibular lateral incisors, buccal surfaces of mandibular second premolars, buccal surfaces of mandibular first molars, occlusal surfaces of maxillary first premolars, occlusal surface of maxillary second premolars, and occlusal surfaces of mandibular second premolars than did normal occlusion group, (table 4).

4. Class III:
The normal occlusion group had statistically greater tooth wear in the incisal surface of maxillary central incisors, incisal surface of maxillary lateral incisors, incisal surface of maxillary canines, incisal surfaces of mandibular central incisors, incisal surfaces of mandibular lateral incisors, incisal surfaces of mandibular canines, palatal surfaces of maxillary central incisors, palatal surface of maxillary lateral incisor, palatal surface of maxillary canines, occlusal surfaces of mandibular first molars and buccal surfaces of mandibular first molars than did class III group, (tables 5). The class III malocclusion group had statistically greater tooth wear in the occlusal surfaces of maxillary first premolars and surfaces of maxillary second premolars than did normal occlusion group, table (table 5).

DISCUSSION

The results of this study showed that the normal occlusion patients and those with class I malocclusion (crowding), class II division 1, class II division 2 and class III had some tooth wear.

However, the groups had different tooth wear patterns, Tables (2-5).

1. Class I malocclusion (crowding)

The normal occlusion group differs from class I with crowding in that the normal occlusion tooth wear was greater on the incisal surfaces of the maxillary canines, compared with the corresponding surfaces of the malocclusion group(table 2), this probably occurred because of the normal anteroposterior relationship, establishing immediate lateral guidance during lateral mandibular excursions [19]. Since these teeth disclude the posterior teeth during lateral mandibular functional movements, it seems logical that they have greater wear, this finding came to be in agreement with Janson *et al.*2010 [23] and Oltramari *et al.* 2010 [24]. As a result of unfavorable positioning of the canines in class I crowding as in many cases of class I coming with buccally malposed canines these teeth also do not disclude the posterior teeth as frequently as in normal occlusion, because of interferences of the posterior teeth [19, 25]. Thus, there is less wear on the incisal surfaces of the maxillary canines in the class I group.

Thus, there is less wear on the incisal surfaces of the maxillary canines in the class I group. The buccal surfaces of mandibular first molars had tooth wear more than the class I malocclusion (crowding), this may be due to the subjects with crowding had narrower arches than the normal occlusion [20, 21] so the maxillary first molars did not probably overlap the mandibular molars. Thus, there is less wear in the buccal surface of mandibular first molar because all of the wear located in areas of occlusal contact [22]. The more tooth wear in incisal surfaces of maxillary and mandibular incisors in class I crowding subjects may be due to irregularities and disarrangement of these teeth, table.

2. Class II division 1 malocclusion

In the normal occlusion group, tooth wear was greater on the incisal surfaces of the maxillary lateral incisors and canines and mandibular central incisors compared with the II division 1 malocclusion (table 3). Greater tooth wear in the anterior region in the normal occlusion group probably occurred because of normal vertical and horizontal anterior tooth relationships, establishing immediate anterior and lateral guidance during protrusion and lateral mandibular excursions, respectively [19, 25]. As we mentioned above these teeth disclude the posterior teeth during mandibular functional movements, so it will have greater wear, this finding came to be in agreement Janson *et al.* [23] and partial agreement

with Oltramari *et al.* [24] and this may be due to size and age of sample.

Class II Division 1 malocclusion group showed greater tooth wear on the posterior teeth (table 3), this may be due to two factors. One is the large overjet that increases the likelihood of interferences of the posterior teeth during protrusion until the incisors make contact as the mandible is advanced [19, 25]. The other is that, because the canines are not in a favorable position to disclude the posterior teeth, these take the role of the canines during lateral mandibular excursions and are therefore subjected to greater wear.

3. Class II division 2 malocclusion

In the normal occlusion group, tooth wear was greater on the incisal surfaces of the maxillary lateral incisors and the maxillary canines, compared with the corresponding surfaces of class II division 2 malocclusion group (table 4). Less wear on the incisal surfaces of the maxillary lateral incisors in the Class II malocclusion group presumably is a consequence of the labial positioning of these teeth in this type of malocclusion, which also is characterized by uprighted central incisors, deep overbite, and normal overjet [26-29] .With this interocclusal arrangement, disclusion on protrusion is carried out primarily by the maxillary central incisors with occasional contact of the lateral incisors. Greater tooth wear on the incisal surfaces of the canines in the normal occlusion group, probably occurred because of the normal anteroposterior relationship, establishing immediate lateral guidance during lateral mandibular excursions [19, 25]. In comparison with normal occlusion, subjects with class II division 2 had greater wear on the labial surfaces of mandibular incisors and this may be due to this type of malocclusion characterized by uprighted central incisors, deep overbite, and normal overjet [26-29] , thus during protrusion subjected to greater tooth wear. Subjects with Class II Division 2 malocclusion had greater wear on the posterior teeth (**occlusal surface** of maxillary first and second premolars and mandibular second premolar and **buccal surfaces** of maxillary second premolar and first molar), a difference that was statistically significant compared with that of the normal occlusion sample, and this may be because the canines are not in a favorable position to disocclude the posterior teeth during lateral excursions in class II division 2 malocclusion, the posterior teeth assume this role and consequently have greater wear than observed in the normal occlusion group. This occlusal configuration occurs because of the broad, square-shaped

maxillary arch with a relatively normal mandibular arch, characteristics of this malocclusion [26-29]. These surfaces are worn during lateral movements of the mandible on the working side.

4. Class III malocclusion

In the normal occlusion group, tooth wear was greater on the incisal surfaces of the anterior teeth (maxillary and mandibular), compared with the III malocclusion (table 5). Greater tooth wear in the anterior region in the normal occlusion group probably occurred because of normal vertical and horizontal anterior tooth relationships, establishing immediate anterior and lateral guidance during protrusion and lateral mandibular excursions, respectively [19, 25], in contrast to subjects with class III malocclusion have lesser tooth wear in anterior teeth and this may be due to many subjects with class III come with edge to edge or sometimes openbite and the overjet and overbite decrease [30-32] ,this seems to be the reasons for less wear in anterior teeth of class III subjects. Due to the reverse relationship in class III malocclusion, the normal occlusion group has greater wear in palatal surfaces of maxillary anterior teeth. On the other hand, subjects with normal occlusion have greater wear in buccal surfaces of mandibular first molars, and the subjects with class III malocclusion have less wear in molars which may be due to the fact that the maxillary arch widths were usually narrower than the mandibular arch widths and lingually positioned maxillary posterior teeth (posterior crossbite) are often seen in the class III malocclusion [33-34], it seems logical that they have less wear in molars. Subjects with class III have fewer teeth wear than the normal occlusion group. On the other hand, patients with Class III malocclusion had greater wear on the maxillary premolars, a difference that was statistically significant compared with that of the normal occlusion sample, and this may be because the canines are not in a favorable position to disclude the posterior teeth during lateral excursions in class III malocclusion, the premolars assume this role and consequently have greater wear than observed in the normal occlusion group.

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Table 1: Criteria used for the measurement of tooth wear, according to the modified tooth wear index

Permanent teeth scores	Criteria	Description
0	Normal _ no evidence of wear	No loss of surface features
1	Incipient _ tooth wear into enamel	Loss of enamel giving a smooth glazed shiny appearance, dentine is not involved
2	Moderate tooth wear into dentine	Extensive loss of enamel with dentine involvement. Exposure of dentine
3	Severe _ tooth wear into pulp or secondary dentin.	Extensive loss of enamel and dentine with secondary dentine or pulp exposure
4	Restored _tooth wear leading to restoration	The tooth received restorative treatment due to tooth wear
9	Could not be assessed	Extensive caries, large restoration, fractured tooth and missing tooth,

Table 2: Intergroup tooth wear comparisons, normal occlusion and class I malocclusion (Mann-Whitney test)

tooth	Normal occlusion		Class I malocclusion (crowding)		P
	Mean of scores	SD	Mean of scores	SD	
Incisal/ occlusal surface					
Maxillary teeth					
Centrals	0.729	0.521	0.867	0.341	0.01*
Laterals	0.552	0.5	0.781	0.415	0.00*
Canines	0.776	0.542	0.539	0.613	0.002*
Mandibular teeth					
Lateral /right	0.765	0.427	0.898	0.303	0.01*
Labial surfaces					
Mandibular teeth					
First molars	0.2	0.402	0	0	0.001*
Statistically significant at P < 0.05					

Table 3: Intergroup tooth wear comparisons, normal occlusion and class II division 1(Mann-Whitney test)

tooth	Normal occlusion		Class II division 1		P
	Mean of scores	SD	Mean of scores	SD	
Incisal/ occlusal surface					
Maxillary teeth					
Laterals	0.529	0.526	0.366	0.484	0.04*
Canines	0.776	0.542	0.533	0.622	0.003*
Second premolars	0.176	0.383	0.288	0.456	0.01*
Mandibular teeth					
Centrals	0.859	0.515	0.7	0.507	0.04*
First premolars	0.294	0.458	0.5	0.503	0.006*
Second premolars	0.129	0.337	0.411	0.495	0.001*
Palatal surfaces					
Maxillary teeth					
Centrals	0.471	0.547	0.444	0.499	0.86
Labial/ buccal surfaces					
Mandibular Teeth					
Canines	0.071	0.258	0.167	0.375	0.049*
Second premolars	0.047	0.213	0.177	0.384	0.007*
First molars	0.2	0.402	0.489	0.489	0.001*
Statistically significant at P < 0.05					

Table 4: Intergroup tooth wear comparisons, normal occlusion and class II division 2 (Mann-Whitney test)

tooth	Normal occlusion		Class II division 2		P
	Mean of scores	SD	Mean of scores	SD	
Incisal/ occlusal surface					
Maxillary teeth					
Laterals	0.529	0.526	0.233	0.43	0.007*
Canines	0.776	0.542	0.2	0.407	0.005*
First premolars	0.388	0.537	0.633	0.615	0.045*
Second premolars	0.176	0.413	0.5	0.731	0.013*
Mandibular teeth					
Second premolars	0.129	0.337	0.3	0.479	0.035*
Labial surfaces					
Mandibular teeth					
Centrals	0.059	0.237	0.2	0.407	0.024*
Laterals	0.024	0.152	0.2	0.406	0.001*
Second premolars	0.047	0.213	0.166	0.379	0.037*
First molars	0.188	0.393	0.5	0.508	0.001*
Statistically significant at P < 0.05					