A STUDY ON THE EFFECTS OF CHEWING PATTERNS TO OCCLUSAL WEAR

Seong-Kyun Kim, Kwang-Nam Kim,
Ik-Tae Chang, Seong-Joo Heo
Department of Prosthodontics, College of Dentistry, Seoul National University

I. Introduction

Particularly chewing movements performed with cooperative interactions among various stomatognathic organs, their proprioceptors, and higher brain centers were closely related to the functional occlusal system.[1] It was thought that any change in any of information on occlusion (in a narrow sense), the temporomandibular joint, and the masticatory muscles would affect the patterns of the chewing movements.

Especially, a number of researchers have argued whether or not the occlusion influences the chewing path. Several researchers found that a part of the path of lateral excursions was present within the chewing path and reported that the path was affected by cuspal inclinations, and supported a relationship between the chewing path and the occlusion.[2-5]

Since human beings have acquired omnivorous eating habits in the process of evolution, the forms of their dentition and teeth could show an appearance in between those of herbivorous and carnivorous animals.[6] According to the report of D'Amico, the chewing path of herbivorous animals clearly differed from those of carnivorous animals.[7,8] Herbivorous animals could easily perform lateral movement. Their chewing paths had almost horizontal tooth sliding surfaces near centric occlusion and therefore they were suitable for eating grasses, plants, etc. In the case of carnivorous animals, chewing paths were vertically and horizontally very narrow. It seemed that the difference between the two types of animal was common to the two typical patterns observed in human beings. Many researchers had made various classifications, but actual chewing paths were complicated and varied.[3] However, despite of the presence of various patterns, two typical patterns had been confirmed. One was more vertical similar to the chopping movement. It had very little sliding of the teeth especially during the opening movement, showing the path only on the chewing side. The other was more lateral(horizontal) type, similar to the grinding movement, with a distinct sliding of the teeth, especially to the non- chewing side during opening movement.

Some of the records during chewing function demonstrated that lateral movements were present in the final phase of natural function.[2,4]

Gradual attrition of the occlusal surfaces of the teeth appears to be a general physiologic phenomenon found in all mammals, in every civilization, and at all ages. Several studies have provided important information about the anatomy and origin of dental wear.[9-35] In 1970, Reynolds[36] reported that the number and extent of facets of wear on all teeth seemed to be more closely related to the length of slide rather than the age of the individual.

Several researchers believed that the temporomandibular joint(TMJ) did not change under physiologic circumstances[37] and that neuromuscular harmony depended on the preservation of the initial morphology of teeth and TMJ. They concluded that teeth remained functional unless they were subjected to severe abrasive phenomena.

The relatively few studies of tooth wear in present-day normal populations refer mainly to adults (Kamp et al., 1984; Lambrechts et al., 1989; P llmann et al., 1987; Woda et al., 1987; Hugoson et al., 1988 ; Dahl et al., 1989).[39-44] This lack of detailed knowledge was partly due to difficulties in measuring techniques. The most frequently used methods were based on clinical grading of the amount of worn tooth substance. Since the wear of teeth in contemporary industrialized populations was small, the ordinal scale of these methods was not sensitive enough for the study of tooth wear in the nomal young permanent dentition.[45]

Planimetric methods (Russel and Grant, 1983)[46] and arbitrary scale (Woda et al., 1987)[42] provided a continuous and more accurate scale that made it possible for detailed information to be gained, comparisons to be made, and trends to be discovered.

In 1987, Gourdon[47] found that values obtained by the planimetric methods and Woda's arbitrary scale showed significant correlation for quantification of the occlusal wear.

In contrast to past generations, who experienced pronounced tooth wear throughout the dentition, urban people of today exhibit greatest wear in the anterior teeth, which have two kinds of wear facets, horizontal and vertical.[44,48]

In 1988, Nishio et al.[49] stated that many facets were observed on the occlusal surfaces of the grinding type group while they were limited to only the cuspid and first premolar in the chopping type group.

The purpose of this study was to evaluate the effects of chewing pattern types on the occlusal wear.

II. Material and Methods

A. Materials

The preliminary study was conducted on120 students of Seoul National University Dental College who had a complete healthy dentition and were between 23 and 25 years of age. Their selection was predicated on the following criteria : absence of missing teeth (except third molars), caries, periodontal disease, bruxism, TMJ disorders, restorations, and history of occlusal or orthodontic therapy. Furthermore, good occlusion with molar relationship in Angle class I and coincidence between maxillary and mandibular midlines were present, along with regular teeth alignment and little evidence of dental wear. The third molars, when present, were not included in the analysis.

To except from other factors related to dental attrition, the questionnaire related to possible background factors of importance for dental attrition (dietary, environmental, working, and parafunctional factors), signs and symptoms of functional disturbances of the masticatory system and recurrent headache[48] was performed on 120 persons(Table 1,2,3).

Table 1. Some of the questions related to dental attrition

Question	Yes.now	Yes, previously but not now	No
Do you spend much time in a dusty environment?		#	
Do you sometimes use your teeth in your work?		#	
Have you had a dry mouth for a long period of time?		#	
Do you often have 'heart burn'(acid regurgitation)?		#	
Do you often vomit?		#	
Do you often clench or grind your teeth?		#	

: used answer in this study.

Table 2. Dietary habits related to dental attrition

Does your diet include/...?	1~2 times a month	1~2 times a week	daily
Citrus fruits		#	
Apples		#	
tomatoes		#	
Coke/Pepsi		#	
Fruit juices		#	
Cider		#	

: used answer in this study.

Table 3. Some reported symptoms related to functional disturbance of the masticatory system

Do you suffer from/...?	Yes, now	Yes, previously but not now	No
Frequent headache		#	
Pain in your jaws and/or face		#	
Dizziness(Vertigo)		#	
Tinnitus		#	

: used answer in this study.

According to the results of the questionnaire, some people who had possible factors of importance for dental attrition or functional disturbances of the masticatory system were excluded. Then, to identify chewing patterns, 84 students of our school were instructed to chew peanuts at arbitrary rhythms on a specific side of the mouth. Each of both unilateral side chewings was performed by each student.

The BioPAK® (BIORESEARCH Inc., Milwaukee, USA) was used to record those movements for 10 seconds from five seconds after the start of chewing.[50,51] When placing the magnet, the center of the magnet was lined up with frenum, but was placed above the frenum at the gingival third of the teeth. Sensor array was placed on the student's head, so the upper crossbar was parallel to the eyes (interpupillary line). The side bar was parallel to Frankfurt horizontal plane(Figure 1,2).[59]

The preliminary study showed two typical chewing patterns. One type was a group of grinding movement path like an herbivorous animal from centric occlusion to the opposite

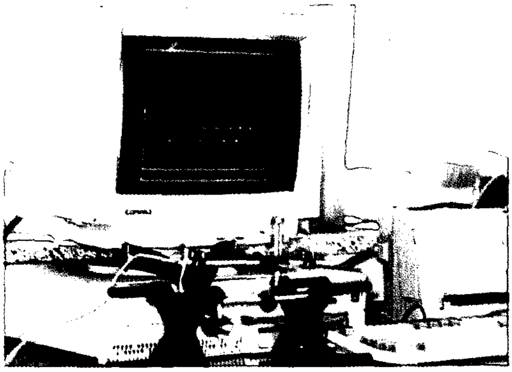
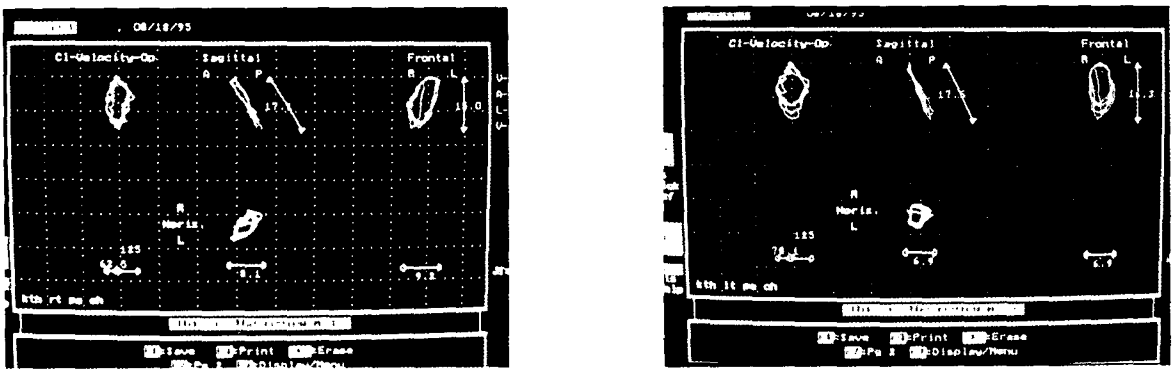


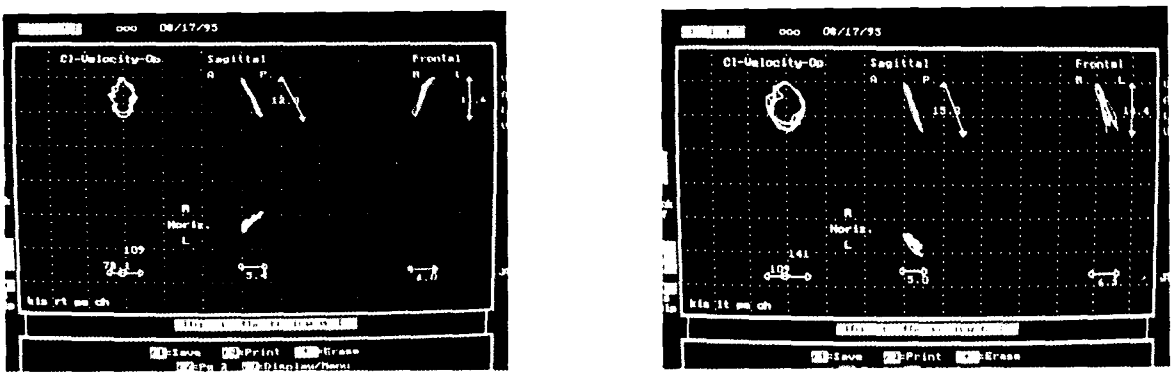
Fig. 1. BioPAK®(version 3.0).

Fig. 2. Attached magnet and sensor array.



A B

Fig. 3. Grinding type ; A, right side chewing B, left side chewing.



A B

Fig. 4. Chopping type ; A, right side chewing B, left side chewing.

side, corresponding to the final phase of chewing cycle described by Nakazawa.[5] This grinding type hereinafter was called G-type (Figure 3). The other type showed a chopping movement path (like a carnivorous animal) with no slide to the opposite side. The chopping type hereinafter was called C-type (Figure 4). Of these 84 persons, 30 persons with standard 2 types of chewing patterns were selected for this study. Fifteen had C-type chewing pattern(age 24± 1 yrs, 10 male and 5 female). Other Fifteen had G-type pattern (age 24± 1 yrs, 10 male and 5 female).

B. Methods

(1) Occlusal wear analysis by use of ordinal scale.

The ordinal scale was used to measure occlusal wear values of subjects.

The following scale of original attrition was applied : 0=no or little wear of enamel only ; 1=marked wear facets of enamel ; 2=wear into dentin ; 3=extensive wear into dentin (>2mm^2) ; and 4=wear into secondary dentin (Table 4). On the basis of these criteria, the assessment was performed on subjects through clinical oral examinations.

To check the examiner's ability to interpret the scores of incisal or occlusal wear,[52] an interindividual comparison was carried out on a randomly selected samples of 16 subjects. Each subject was scored independently by each of three examiners.

Only 20 teeth of 448 teeth showed disagreed scores. Therefore, the agreement in judgement between observerswas very high (96%).

(2) Occlusal wear analysis by use of arbitrary scale.[42]

Impressions of both dental arches were made in silicone elastomer and only the dental part of the impression was poured in artificial stone.[53] Microbubbles were eliminated from maxillary and mandibular casts, and the form, dimension, and location of wear facets were analyzed with a magnifying lens. These observations were drawn on a cast of each arch, with care taken to reproduce form and location of wear facets in relation to grooves and margins.

We observed that all available wear facets were engaged during working and non-working simulated contact movements(Figure 5). Both types of wear facets (working and non-working) in posterior teeth were shaded in different colors. We observed vertical facets and horizontal facets in anterior teeth. Both types of wear facets (vertical and horizontal) in anterior teeth were shaded in different co-

Table 4. Ordinal scale used for grading severity of occlusal wear

Grade	Degree of occlusal wear
0	No visible facets in enamel ; occlusal/incisal morphology intact
1	Marked wear facets in enamel ; occlusal/incisal morphology altered
2	Wear into dentin ; dentin exposed ; occlusal/incisal morphology changed in shaped with height
3	Extensive wear into dentin ; larger dentin area(>2mm) exposed ; occlusal/incisal morphology totally lost locally or generally ; substantial loss of crown height
4	Wear into secondary detin

lors (Figure 6).

Arbitrary scale used to quantify the surface of wear facets Arbitrary scales were used for both the anterior and the posterior teeth.

Anterior teeth were assigned arbitrary values (1 to 4) (Figure 7) as follows :

1=One or several facets located only on the palatal or buccal surface of the tooth.

2=One or several facets present only on the incisal edge.

3=One or several facets present on the incisal edge and also on the palatal or buccal surfaces, but occupying less than one third of longitudinal length of tooth crown.

4=One or several facets present on the incisal edge and also on the palatal or buccal surfaces, and occupying more than one third of longitudinal length of tooth crown.

Posterior teeth were assigned the following arbitrary values (1 to 5) (Figure 8) as follows :

1=Facets occupying in buccolingual direction less than one third of cusp side.

2=Facets occupying in buccolingual direction more than one third of cusp side.

3=Facets occupying a total cusp side.

4=Facets occupying in buccolingual direction three complete cusp sides (external working, internal working, and non-working) that are not situated in the same frontal plane.

5=Facets occupying in buccolingual direction three complete and contiguous cusp sides situated in the same frontal plane.

(3) Statistical analysis

Differences between groups were tested by means of *t−test* (SPSS/PC+).

The level of statistical significance used was $p<0.05$.

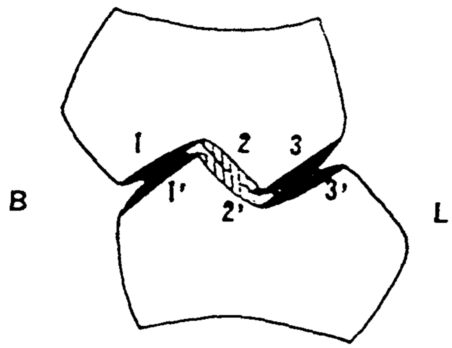
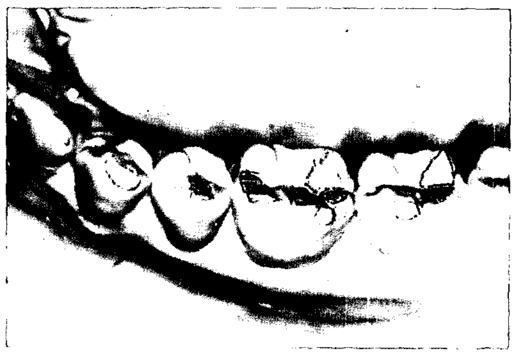


Fig. 5. Diagram of three funtional cusp sides on which working facets(1, 1′, 3, 3′) and non-working facets(2, 2′) are distributed.

A



B

Fig. 6. A, Example of wear facets
B, their representation on the cast.

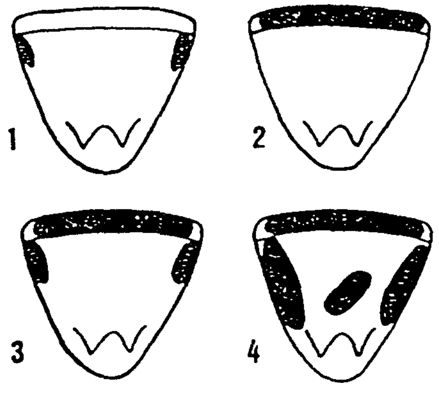


Fig. 7. Diagiram of arbitrary criteria chosen to qualify wear facets of incisors and canines.

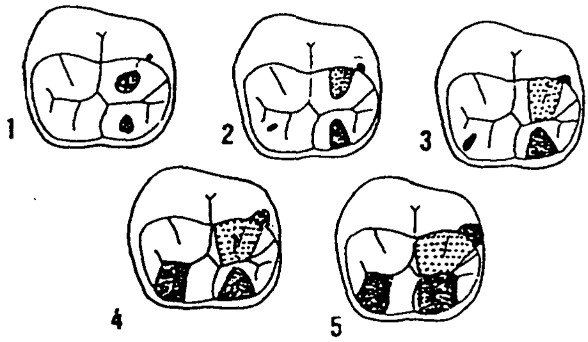


Fig. 8. Diagram of arbitrary criteria chosen to qualify wear facets of molars and premolas.

III. Results

(1) Occlusal wear values obtained by use of ordinal scale.

Means and standard deviations were calculated for each group in all teeth and in each segment. These figures were used for a comparative study of the occlusal wear values between the G-type and C-type subjects

1. The mean occlusal wear value in all teeth (Table 5, Figure 9)

The mean occlusal wear value in all teeth, obtained by use of ordinal scale, was not significantly different between the C-type and G-type group.

2. The occlusal wear values in each segment (Table 6, Figure 10)

The occlusal wear values in each segment, obtained by use of ordinal scale showed very small differences between two groups.
But these did not show significant differences between the C-type and G-type group.

(2) The occlusal wear values obtained by use of arbitrary scale.

Means and standard deviations of occlusal wear values were calculated for each group

Table 5. Occlusal wear values in all teeth obtained by ordinal scale

Variables	C-type	G-type
mean	1.1736	1.2132
SD	0.168	0.178

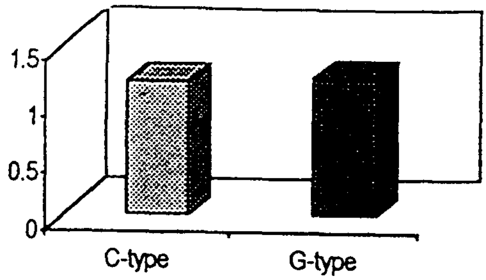


Fig. 9. Occlusal wear values in all teeth obtained by ordinal scale.

in all teeth and in each segment.

1. The mean occlusal wear value in all teeth (Table 7, Figure 11)

The mean occlusal wear value in all teeth, obtained by use of arbitrary scale, was significantly greater in the G-type than in the C-type group ($p<0.05$).

This result was similar to that reported by Nishio et al.[49]

Table 6. Occlusal wear values obtained by ordinal scale

Variables		C-type	G-type
UP	mean	1.0583	1.125
	SD	0.114	0.206
LP	mean	1.025	1.05
	SD	0.097	0.092
P	mean	1.0417	1.0875
	SD	0.099	0.143
UA	mean	1.2667	1.3333
	SD	0.242	0.227
LA	mean	1.3444	1.3444
	SD	0.392	0.299
A	mean	1.3056	1.3389
	SD	0.29	0.243

UP : upper posterior teeth, LP : lower posterior teeth, P : posterior teeth
UA : upper anterior teeth, LA : lower anterior teeth, A : anterior teeth.

Table 7. Occlusal wear values in all teeth obtained by arbitrary scale

Variables	C-type	G-type
mean	2.8792	3.1771
SD	0.377	0.281

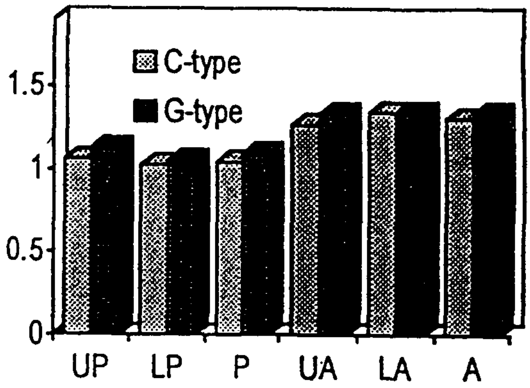


Fig. 10. Occlusal wear values obtained by or dinal scale.

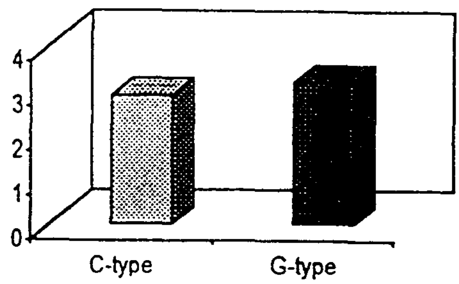


Fig. 11. Occlusal wear values in all teeth ob tained by arbitrary scale.

2. The occlusal wear values in each segment (Table 8, Figure 12)

The occlusal wear values in posterior teeth, obtained by use of arbitrary scale, were significantly greater in the G-type than in C-type group. ($p<0.05$).

But the occlusal wear values in anterior teeth were not significantly different between the C-type and G-type group.

(3) The frequency of non-working facets (Table 9, Figure 13)

The frequencies of non-working facets were calculated for each group in all posterior teeth and each of posterior segments. These figures were used tocompare the difference of the frequency between the C-type and G-type group.

The frequency of non-working facets in posterior teeth showed no significant differencs between the C-type and G-type group. Working facets were found in all posterior teeth regardless of chewing patterns. The non-working facets were found in 82% of upper posterior teeth, in 71% of lower posterior teeth, and in 79% of posterior teeth.

(4) The frequency of vertical facets (Table 10, Figure 14)

The frequencies of vertical facets were calculated for each group in all anterior teeth and each of anterior segments.

Table 8. Occlusal wear values obtained by arbitrary scale

Variables		C-type	G-type
UP	mean	2.1583	2.9839.
	SD	0.514	0.403
LP	mean	3.2250	3.6250
	SD	0.668	0.263
P	mean	3.1979	3.8042.
	SD	0.546	0.301
UA	mean	3.0444	3.0222
	SD	0.582	0.672
LA	mean	2.0889	2.0778
	SD	0.139	0.124
A	mean	2.5667	2.5500
	SD	0.317	0.356

UP : upper posterior teeth, LP : lower posterior teeth, P : posterior teeth
UA : upper anterior teeth, LA : lower anterior teeth, A : anterior teeth.

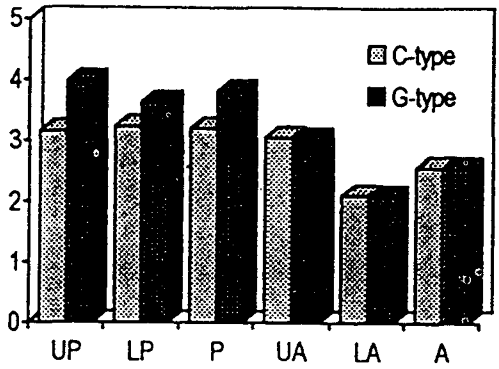


Fig. 12. Occlusal wear values obtained by arbitrary scale.

Table 9. The frequency of non-working facet

Variables		C-type	G-type
UP	mean#	6.2667	6.8667
	SD	1.486	1.356
LP	mean#	5.6667	5.7333
	SD	1.291	1.624
P	mean#	11.9333	12.6000
	SD	1.907	2.828

UP : upper posterior teeth, LP : lower posterior teeth, P : posterior teeth
: mean number of teeth with non-working facets.

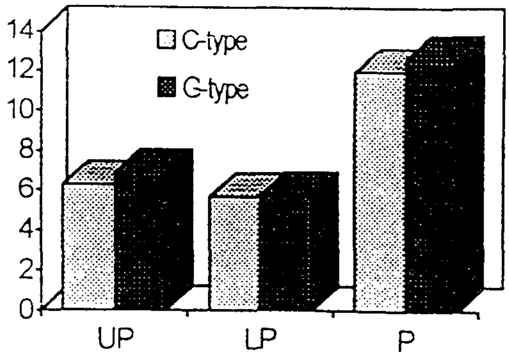


Fig. 13. The frequency of non-working facets

Table 10. The frequency of vertical facets

Variables		C-type	G-type
UA	mean#	4.5333	5.0000
	SD	1.846	1.604
LA	mean#	0.4000	0.4667
	SD	0.737	0.743
A	mean#	4.9333	5.4667
	SD	1.944	1.959

UP : upper posterior teeth, LP : lower posterior teeth, A : anterior teeth
: mean number of teeth with vertical facets.

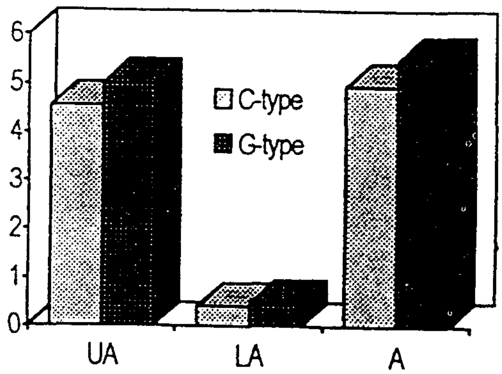


Fig. 14. The frequency of vertical facets.

The frequency of teeth with vertical facets in anterior teeth showed no significant differences between the C-type and the G-type group. The vertical facets were found in 79% of upper anterior teeth, in 7% of lower anterior teeth, and in 39% of anterior teeth.

Ⅳ. Discussion

Theoretical interest

Chewing movements are smoothly performed functional movements when the occlusion, temporomandibular joint, masticatory muscles, and higher brain centers constituting the functional occlusion system[1] function in harmony with one another. Therefore, disturbances occurring in any of these will affect the chewing movements. Indeed, disturbance of the chewing movement is well recognized in patients with dysfunction. In our clinical practice, we often encounter situations in which the chewing path improves with the improvement of symptoms. Several researcher reported that pathological changes in the temporomandibular joint area influence chewing movements.[54,55] Among studies examining the chewing path from the viewpoint of occlusion, there were reports, including Jankelson's,[56] which took the position that no occlusal contact was observed during chewing. Lately, however, there seemed to be other reports emphasizing a relationship between the chewing path and occlusion. Ai[2] stated that those with a steep cuspal inclination showed a more vertical type of chewing movement, while those with gentle cuspal inclination showed a more lateral type of chewing movement.

In studying the relationship between chewing path and occlusion, a number of researchers have made various classifi cations of chewing paths including Zsigmondy's three-phase theory, Gysi's four-phase theory, and Nakazawa's five- phase theory. However, actual chewing paths are complicated and vary from individual to individual. Therefore, it would seem that a detailed classification would complicate the problem even more in studying the relationship with occlusion. However, despite the presence of various patterns, two typical patterns were confirmed. One is a more vertical type of movement similar to the chopping movement, with very little sliding of the teeth, especially during the opening movement, showing a path only on the chewing side. The other is a more lateral(horizontal) type, similar to the grinding movement, with a distinct sliding of the teeth, especially to the nonchewing side during the opening movement, showing a path across the chewing and nonchewing sides.

Not all the 84 subjects belong to these two types ; 50 subjects, other than the 19 G-type and 15 C-types, showed intermediate chewing paths that fall into neither of the two types, or different patterns. It is of great significance to compare the occlusions of normal subjects with the two typical patterns in studying the chewing path in relation to occlusion. For this reason, normal subjects with G-type and C-type chewing movement patterns were selected.

Projections on the frontal plane of the paths of lateral border movement and opening and closing movement obtained by BioPAK were used for comparison, showing the differences in the occlusal wear values between two groups.

In this study, one difference is that the occlusal wear values, obtained by use of arbitrary scale, were greater in the G-type group than in the C-type group. These seem to correspond to the facets during the movement corresponding to the closing phase described by

Schweitzer.[3] The other point of difference provides rationale for the first point. Inclinations of movement paths shown on the frontal projections of lateral border movement paths were gentle in the G-type group and relatively steep in the C-type group. When these results are added together, the following hypothesis can be derived from the fact that the G-type group showed gentle inclinations of lateral border movement and the presence of many facets on the occlusal surfaces of the posterior teeth : the upper and lower posterior teeth of the G-type group are relatively close to each other not only in centric occlusion, but also in lateral positions, while the upper and lower posterior teeth of the C-type group are separated in lateral positions.

When the lateral border movement inclination is gentle and the upper and lower posterior teeth, which play a major role in the chewing movement, come very close to each other during the lateral movement on both sides, the occlusal status is such that chewing functions can be performed sufficiently not only in centric occlusion but also in lateral positions. It can be said that, because of such an occlusal status, the inner inclines of the functional cusps of the upper and lower teeth guide each other during the movement from the working side to centric occlusion and further, to the opposite side, which is accompanied by the sliding of the occlusal surfaces of the posterior teeth. Chewing food by surface(grinding) is a more efficient and rational chewing pattern suited for that occlusal status.[49]

In 1993, Dahl[44] reported that there were many factors that could influence the type and rate of wear. These factors were time/age, gender, occlusal conditions, hyperfunction, bite force, gastrointestinal disturbances, nutrition, environmental factors, salivary factors, and other factors.

In 1991, Johansson[52] reported that the factors of importance for dental attrition were bruxism, biting habits, and fruit juices. But there was no correlation between subjects from differing geographic and/or climate habits and the severity of tooth wear.

Reynolds[36] reported that the number and extent of facets of wear was related as follows ; 1) The length of the slide from terminal hinge relation to maximum intercuspation, 2) A lack of eccentric 「disclusion」 of the posterior teeth.

In 1988, Nishio[49] stated that many facets were observed on the occlusal surfaces of the G-type models. He stated that these seemed to be the result of many years of G-type chewing, while they were limited to only the cuspid and first premolar in the C-type group. But in this study, the occlusal wear facets in the C-type group were found in all posterior teeth. These seem that the chewing patterns have a little effects on the occlusal wear. Many factors of importance for occlusal wear,[43,44] other than the chewing patterns, have had more effects on these subjects. Therefore, the chewing patterns are one of the etiological factors, which have a little effects on the occlusal wear.

In this study, the occlusal wear values, obtained by use of ordinal scale, were not significantly different between the C-type and the G-type group. But the occlusal wear values, obtained by use of arbitrary scale, was significantly greater in the G-type than in the C-type group. These seem to be as follows ; The first, the ordinal scale is not sensitive enough for the study of the occlusal wear in the normal young permanent dentition.[45] The second, the difference of chewing movements between the C-type and G-type group is related to the length of the slide. Therefore, the arbitrary scale is more suitable for identifying the occlusal wear values accorded to chewing patterns.

In this study, the occlusal wear values in anterior teeth, obtained by use of arbitrary scale, were not different between the C-type and the G-type group. These seem that the occlusal wear in anterior teeth is more affected by the incisal guidance.[3,57] In this study, all dental arches presented many wear facets. All of the teeth displayed facets.

Working facets were found in all posterior teeth. The non-working facets were found in 82% of upper posterior teeth, in 71% of lower posterior teeth, and in 79% of posterior teeth. Wear facets in posterior teeth were seen on the surface of the three functional cusp sides.

The working facets in premolars were usually absent from internal working cusp sides because of the low height of mandibular lingual cusp, which prevented any possibility of contact in this surface.

In the 12 anterior teeth, wear facets took different forms. Horizontal facets were located on incisal edges and at cusp tips, whereas vertical facets appeared palatally in maxillary and labially in mandibular anterior teeth. According to Woda et al.,[42] horizontal facets occlude relatively far from the intercuspal position, but vertical facets occlude close to intercuspal position. Jankelson[56] suggested that vertical facets are formed predominantly by chewing, incision, and deglutition, whereas horizontal facets are typical of bruxism. These results seem to be the reason for our results. The frequency of vertical facets in anterior teeth showed no significant differences between the C-type and the G-type group.

Clinical interest

The ideas developed in this article are mainly theoretical. They do, however, raise some questions of clinical interest.

1. The chewing pattern is one of the etiological factors related to the occlusal wear.

2. If dental wear is a natural process, the introduction of metallic or ceramic prosthetic surface(which are harder than tooth surface) will prevent normal abrasion and will counteract physiologic changes of the tooth surface. Hardness equal to that of the tooth should be an important factor in the choice or research of dental biomaterials.

3. Occlusal contacts are surfaces that increase in diameter with the development of abrasion. When prosthetic treatment or occlusal correction are required, occlusal surfaces in a convex form may not really be necessary.

4. The presence of nonworking facets and the evidence of non-working contacts during chewing[58] indicate that a prophylactic elimination of all non-working contacts will eliminate a great part of the functional field of mastication.

5. A diagnosis of bruxism whenever wear factor are found is not a reliable method diagnosis.

V. Conclusions

15 subjects with chopping chewing pattern and 15 subjects with grinding chewing pattern were selected by use of jaw tracking device.

The occlusal wear values, obtained by ordinal scale and arbitrary scale, were calculated for each group. The frequencies of non-working facets in posterior teeth and vertical facets in anterior teeth were calculated for each group.

1. The mean occusal wear value in all teeth, obtained by use of ordinal scale, was not significantly different between the chopping and the grinding type group ($p>0.05$).
2. The occusal wear values in each segment,

obtained by use of ordinal scale were not significantly different between the chopping and the grinding type group ($p>0.05$).

3. The mean occusal wear value in all teeth, obtained by use of arbitrary scale, was significantly greater in the grinding type than in the chopping type group ($p<0.05$).
4. The occusal wear values in posterior teeth, obtained by use of arbitrary scale, were significantly greater in the grinding type than in the chopping type group ($p<0.05$). But the occlusal wear values in anterior teeth were not significantly different between the chopping and grinding type group.
5. The frequency of non-working facets in posterior teeth showed no significant differencs between the chopping and grinding type group ($p>0.05$).
6. The frequency of vertical facets in anterior teeth showed no significant differencs between the chopping and grinding type group ($p>0.05$).

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국문초록 –

저작형태가 교합면 마모에 미치는 영향에 관한 연구

서울대학교 치과대학 치과보철학교실

김성균 · 김광남 · 장익태 · 허성주

저작은 치아, 악골, 저작근 뿐만 아니라 근 신경계, 고위 중추까지 복합적으로 관여되는 기능적 행위이다. 저작 형태는 다양한 모양을 가지나 두 가지 전형적인 군, 즉, 전방에서 관찰 시 그 양상이 수직적이며 절단 (chopping) 운동을 하는 군과 주로 측방으로 이루어지며 연마 (grinding)를 하는 군으로 나눌 수 있다.

본 연구의 목적은 저작 형태의 차이가 교합면 마모에 미치는 영향을 조사하는 것이다.

두개 하악 관절과 저작 습관에 이상이 없으며 교합면에 수복물이 없는 치과 대학생으로 하악 운동 궤적 기록기를 이용하여 상기의 전형적인 2가지 저작 형태를 보이는 각 15명씩을 피검자로 선택하였다. 각 피검자에 대한 임상 검사를 통해 ordinal scale로 교합면 마모의 등급을 조사하여, 평균 치아 마모도와 부위에 따른 치아 마모도를 비교 조사하였다. 각 피검자에 대한 인상 채득 후 모형을 제작하고 arbitrary scale로 교합면 마모의 등급을 조사하여, 평균 치아 마모도와 부위에 따른 치아 마모도를 비교 조사하고 저작측과 비저작측 마모를 비교 조사하였으며 수평 마모면과 수직 마모면을 비교 조사하였다.

1. 평균 치아 마모도는 ordinal scale로 측정하였을 때, 절단형과 연마형간에 유의할 만한 차이가 없었다. ($p > 0.05$)
2. 부위에 따른 치아의 마모도는 ordinal scale로 측정하였을 때, 절단형과 연마형간에 유의할 만한 차이가 없었다. ($p > 0.05$)
3. 평균 치아 마모도는 arbitrary scale로 측정하였을 때, 절단형에 비교하여 연마형에서 높은 마모도를 보였다. ($p < 0.05$).
4. 절단형에 비교하여 연마형은 arbitrary scale로 측정하였을 때, 구치부에서는 높은 마모도를 보였으며 전치부에서는 유의할 만한 차이가 없었다($p < 0.05$)
5. 구치 평균 치아 마모도와 부위에 따른 치아의 마모도는 균형측에서 절단형과 연마형간에 유의할 만한 차이를 보이지 않았다 ($p > 0.05$).
6. 전치 평균 치아 마모도와 부위에 따른 치아의 마모도는 수평 마모면과 수직 마모면 비교시, 절단형과 연마형간에 유의할 만한 차이를 보이지 않았다. ($p > 0.05$)

중심어 : 저작형태, 교합면 마모, 비작업측 마모, 수직 마모면