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Relationship between the Preferred Chewing Side and the Angulation of Anterior Tooth Guidance

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Key Words
Anterior guidance · Preferred chewing side · Tooth wear

Abstract
Objectives: The aim of this study was to evaluate a possible relationship between preferred chewing side (PCS) and the anterior guidance angle. ***Subjects and Methods:*** Forty dental nurses and technicians, aged 24–46 years, were each given a piece of chewing gum, which they chewed for about 3 min. At 7 regular intervals (every 15 s), they were interrupted by the principal investigator (P.L.) in order to observe on which side of their mouths they had the bolus of chewing gum. Moulds of their jaws were made and the position of the maxillary arch relative to temporomandibular joints was recorded with a facebow and transferred to a semi-adjustable articulator. After mounting the stone casts of each subject, a measure of the anterior guidance angle was taken with an adjustable incisal table. ***Results:*** Of the 40 subjects, 14 (35%) presented a PCS. Among the 14 subjects who preferred a chewing side, there was a correlation between the PCS and a low angulation of teeth constituting the anterior guidance on that side, but this correlation was statistically nonsignificant. ***Conclusion:*** In this study, we found that unilateral chewing creates uneven wear on the anterior teeth and changed the anterior guidance angulation.

Introduction

For the majority of human physical activity there exists a preference in the use of one side of the body, be it with the hands, feet or eyes [1]. Mastication is not different, and there seems to be a preferred chewing side (PCS) for many individuals as previously reported [1–19]. The PCS, also called chewing side preference, is the side of the dentition where most of the chewing takes place during mastication [2]. Researchers tend to disagree on whether the PCS is determined in the central nervous system, or is rather related to various peripheral factors such as the occlusion and food texture [3–5]. Generally, the presence of a PCS is associated with the number of functional occlusal contacts between maxillary and mandibular teeth in lateral excursion [6]. However, even in the presence of a full complement of posterior teeth on the right and left sides, there is still a preference for chewing unilaterally in many individuals. Numerous studies have been done on the PCS and the possible factors affecting PCS have been reviewed extensively [7–12]. These possible factors include occlusion [7], handedness, footedness, eyedness and earedness [1], 2- to 8-year-old children [8], deciduous and mixed dentition [9], areas of functional occlusal contacts [10], facial biotype and head posture [11], the presence of caries and pain [12] and food texture [13].

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Different methods have been used to determine the PCS: visual observation after 1, 3, 5 or 7 consecutive chewing cycles [14], kinesiography [15], questionnaire on chewing habits [16], measurement of bite force [17], masticatory performance [18] and anterior disc displacement [19].

The anterior guidance (AG) is one factor that has never been linked to PCS. AG is the path followed by the mandibular anterior teeth making contact with the lingual surface of the maxillary anterior teeth during the lateral movements of the jaw. Its angulation (AGA) is determined by the steepness and lingual curvature of the upper anterior teeth or, in other words, by the amount of horizontal overlap (overjet) and vertical overlap (overbite) between the maxillary and mandibular anterior teeth. Very few studies have been conducted on AG. A study by Kohno and Nakano [20] showed that AG had a greater influence on mandibular movements than the anatomy and function of the temporomandibular joints but no mention was made of its influence on the chewing activities of individuals. Over time, mastication will result in some attritional wear between opposing anterior and posterior teeth through food contact and tooth contact [21]. More specifically, anterior tooth wear is likely to affect their spatial relationship and bring a change in the angulation of the teeth surfaces responsible for guiding the jaw into closure. As tooth wear takes place, AGA would likely decrease and get smaller (flatter). If chewing is mostly unilateral as is the case when there is a PCS, the anterior teeth should wear more on that side and the AGA should be smaller than on the opposite side. In fact, there is no evidence linking a difference in AGA resulting from tooth wear to a preference for chewing on one side.

The aim of this study was to establish if PCS was present in a sample of young subjects, to measure the AGA and to determine if there is a correlation between the two. This study was planned to provide evidence that a small (flat) AGA on one side of the mouth would be preferred to a larger (steeper) one, and that the PCS would be the side with the smaller angulation.

Subjects and Methods

The dentition of 40 dental nurses (hygienists and assistants) and dental technicians (35 females and 5 males) aged 24–46 years, working at the Kuwait University Dental Clinic, was examined clinically. Only one subject was left-handed. Subjects presented either a full complement of teeth or no more than 1 missing posterior tooth (such as premolars and molars) per quadrant, excluding the wisdom teeth. Since the horizontal overlap is an important factor of AGA, we selected all 40 subjects with a class I (angle) occlusal relationship and some horizontal and vertical overlap. The selected subjects presented no dental or oral pathology, no symptoms of temporomandibular disorder, no parafunctional habit and none of them was undergoing orthodontic treatment. Exclusion of subjects according to these abovementioned conditions was established at the time of oral examination. All participating subjects confirmed having chewed gum previously. Their age and handedness was recorded. The degree of real wear in the subjects' teeth was not evaluated by the principal investigator (P.L.). The project was approved by a Joint Committee for the Protection of Human Subjects in Research and the subjects signed a written informed consent.

Alginate impressions of their teeth were taken and poured with a type III model stone. Casts were mounted onto a type III semi-adjustable articulator (Whip Mix series 4000, Whip Mix Corp., Louisville, Ky., USA) with a fast-setting mounting plaster (Whip Mix Corp.). Maxillary casts were mounted with a facebow transfer using the Whip Mix Ear Facebow. Mandibular casts were hand-articulated into maximum intercuspal position. The articulators' condylar elements were set arbitrarily: the horizontal condylar inclination was set at 30° as is recommended in current textbooks [22], and the lateral angulation set at 15°. To measure the AG angle, the articulator was fitted with an adjustable incisal guide table (Hanau adjustable guide table, Whip Mix Corp.), which allowed a reading of up to 45° in the frontal plane. Once mounted, the centric latches were unlocked and maxillary models were moved into right and left laterotrusion for a distance of about 5 mm (as visualized on the incisal table) till the canines and lateral incisors were seen to make sufficient contact to create separation of the posterior teeth (fig. 1). The AGA was read from the incisal table after the wings were brought into light contact with the incisal pin. The readings were done with a hand-held ×3.5 optical magnifier (Kaiser Fototechnik, Buchen, Germany) (fig. 2). The smaller angulation was labeled as either right (R) or left (L), or same (S) if the difference between right and left was <2°. The 2 examiners (P.L. and Y.A.-T.) who did the readings were calibrated before the study and were ignorant of the PCS when evaluating the AGA.

The method of visual observation was used (P.L.) to determine the PCS. A visual spot-checking of the bolus location between the teeth was made as they were chewing. The observation of the bolus in between their teeth identified the side they were using. Subjects were given a piece of sugarless chewing gum (1.5 g) of their choice and they were instructed to chew it. The chewing material chosen was easy to form into a bolus quickly and did not require excessive movements or pressure as would have been the case with a harder material. Such a soft chewing gum keeps its consistency (texture) over a long period of time and therefore allows the chewing strokes to be similarly repetitive and of the same intensity. After an initial period (20 s) to break down the gum into a bolus, their chewing was interrupted every 15 s and the position of the bolus was recorded as being on the right (R), the left (L) and occasionally in the front (F) between the incisors. This procedure was carried out 7 times, consecutively. Subjects were labeled as having an 'observed' PCS if they were observed chewing 6/7 or 7/7 times on the same side. For those subjects that showed a PCS, the AGA was paired with the preferred side previously recorded. The relationship between PCS and AGA was considered positive if the smaller angula-

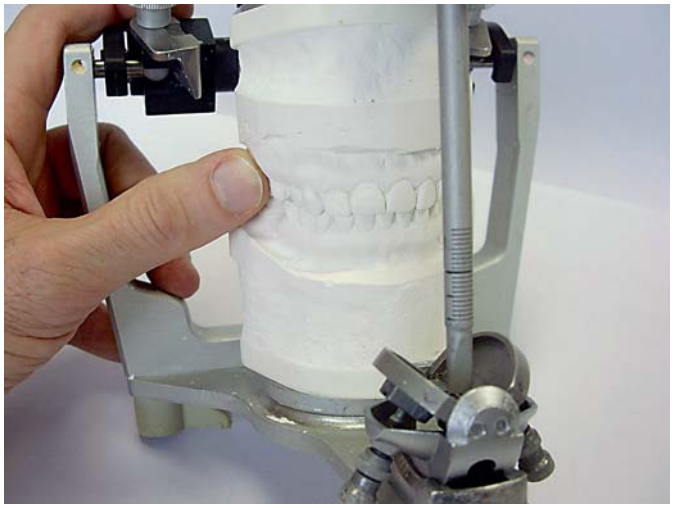

Fig. 1. The maxillary casts were moved laterally to a distance of 5.0 mm on the incisal table.

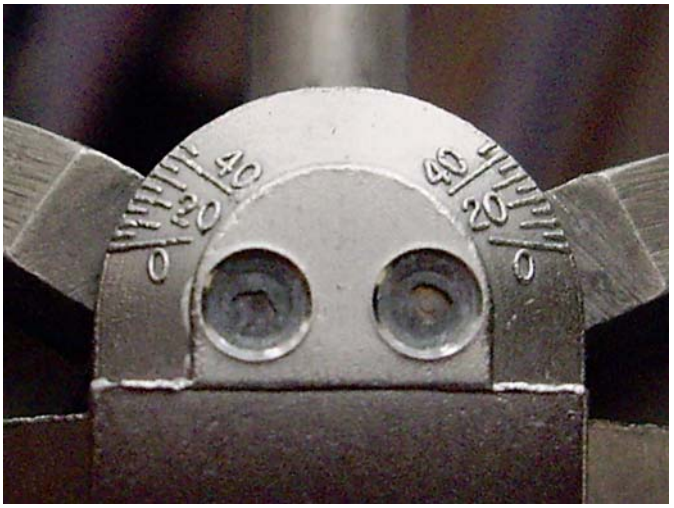

Fig. 2. A left angulation of 21° and a right angulation of 27° can be read when raising the wings of the incisal table.

tion matched the PCS, and negative if it did not match it. The SPSS program (version 17) was used for the statistical analysis. The mean difference of AGA was compared with PCS (right, left and no preference) by means of an ANOVA test. The Student t test was used to compare the right and left side preference. The level of statistical significance was $p < 0.05$.

Results

The mean age of the subjects was 30.6 (SD = 5.6) years for females and 34.6 (5.1) years for males. Of the 40 subjects, 14 (35%) presented a PCS: 8 of the 14 (52%) on the right and 6 (43%) on the left (fig. 3). The remaining 26 (65%) had no real preference, alternating between the right and left side. Six (15%) of these subjects even used their front teeth on occasional strokes.

Anterior Guidance Angulation

The AGA for the 14 subjects is given in table 1. The AGA mean difference between the right and left chewers was 6.1°, and this difference was not significant ($p = 0.41$).

Relationship between PCS and AGA

Of the 14 subjects with a PCS, 11 (78.6%) presented a PCS on the side showing a smaller AGA (table 2). Therefore, it can be said that the majority of our subjects displaying a PCS presented more wear on the anterior teeth of that same side, but that this difference was not statistically significant.

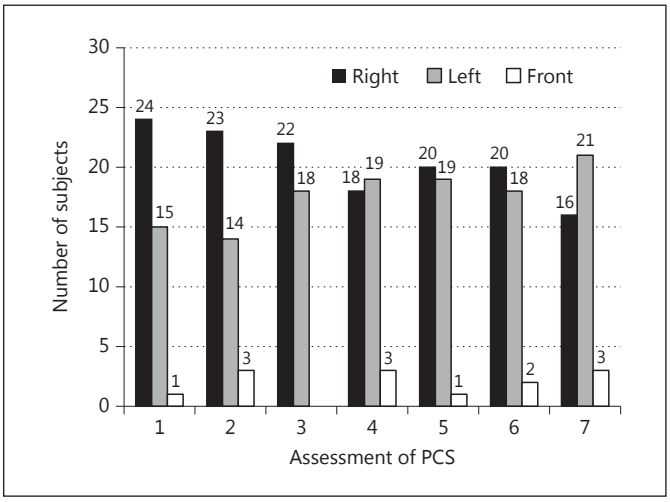

Fig. 3. Assessment of PCS during 7 cycles for 40 subjects.

Discussion

In this study, the size and the number of tooth contacts of the occlusal table was not identified because the objective was not to determine factors responsible for the chewing side preference, but rather to find out if a chewing preference for one side resulted in creating more wear on the teeth responsible for the guidance. Previous authors who have used the direct visual observation method determined the PCS at the first cycle (or stroke) [1, 23] or if 5, 6 or 7 out of 7 cycles were on the same side. The num-

Table 1. AGA in degrees for the 14 subjects

Subject No.	Examiner 1		Examiner 2		Average		Lower side of AGA	Difference in angulation
	L	R	L	R	L	R		
2	45	32	42	31	43.5	31.5	R	12
3	42	35	44	33	43	34	R	9
5	36	41	34	40	35	40.5	L	+5.5
8	24	22	24	20	24	21	R	3
11	40	35	43	36	41.5	35.5	R	6
12	26	24	24	30	25	27	L	+2
19	31	39	30	36	30.5	37.5	L	+7
20	30	23	26	22	28	22.5	R	5.5
21	31	25	27	26	29	25.5	R	3.5
25	30	24	26	23	28	23.5	R	4.5
27	42	35	42	34	42	34.5	R	7.5
28	34	45	32	42	33	43.5	L	+10.5
36	26	16	26	20	26	18	R	8
38	34	35	32	35	33	35	L	+2

Mean right = 5.4; mean left = 6.8; overall mean = 6.1

Table 2. Relationship between the PCS and the AGA

Subject No.	PCS	Lower side of AGA	Relationship
2	R	R	positive
3	L	R	negative
5	R	L	negative
8	R	R	positive
11	R	R	positive
12	L	L	positive
19	L	L	positive
20	L	R	negative
21	R	R	positive
25	R	R	positive
27	R	R	positive
28	L	L	positive
36	R	R	positive
38	L	L	positive
Total = 14	8 (R) 6 (L)		11 positive 3 negative

ber of cycles varied with authors. Some [17] used 11 cycles out of 20 (55%), while others [15] have used 8 out of 10 cycles (80%). We chose 6 (85%) and 7 times out of 7 as it gave a better picture of those with a true PCS. If 5 cycles out of 7 (71%) on the same side had been chosen, the percentage of subjects with a PCS would have been 52.5%. The choice of a higher percentage accounts for the fact that only 35% presented a PCS, which is low relative to other studies [9, 15, 16].

The etiology of the wear was assumed to originate from tooth/food contacts during chewing as none of the subjects in this study had any history or evidence of bruxime or temporomandibular disorder. Generally, maxillary and mandibular anterior teeth do not actually participate in the chewing of food themselves [6]. Nevertheless, besides their contact during the initial incision, anterior teeth are likely to get in contact with one another throughout the chewing cycle (stroke) because they guide the jaw into closure. This explains why chewing is likely to bring on wear [21], not only on the posterior teeth but also on the teeth guiding the jaw into final closure, i.e. the anterior teeth which constitutes the AG. Considering that our sample population was rather young (an average age of 31.2 years), the observation of such a difference in the AGA is indeed a reason for concern because wear is likely to continue and the habit of preferring one side to the other is likely to generate more wear and become a vicious circle: the side with a smaller (flatter) angulation being preferred for chewing and chewing on it in turn making it smaller.

Wear studies by Beyron [21] have shown that in the Australian aborigines, bilateral mastication was likely to result in the most even and harmonious wear pattern. On the other hand, the habit of preferring one side for chewing may be detrimental over time because wear is likely to

be uneven and to change the AGA. Nowadays, dentists should be aware of the long-term risks of unilateral chewing and they should bear this in mind when restoring the anterior teeth of patients presenting signs of a PCS and evidence of anterior tooth wear.

Conclusions

A minority (35%) of the subjects presented a PCS and of these, a majority had a smaller anterior tooth guidance angulation on that side, i.e. they displayed more anterior tooth wear on the PCS. The AGA on the preferred side was not statistically significant from that on the other side.

This study was a pilot study on a small sample to investigate the hypothesis of a relationship between PCS and AGA. The hypothesis was not confirmed because of the small number of participants. In addition, the sample consisted of dental personnel and not the general population. Further studies with a representative sample would be justified.

Acknowledgements

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