



Characterization of Physiologic Occlusion

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Abstract

Objectives: To characterize and describe the occlusal relationship in Thai subjects with physiologic occlusion.

Materials and methods: One hundred and twenty-four subjects (49 males and 75 females) fulfilled the criteria of physiologic occlusion by Mohl (1988) were examined for the static and dynamic occlusal relationship. Total number of tooth, horizontal and vertical overlap, Angle's classification were examined for static occlusion. For dynamic occlusion, maximum mouth opening including lateral and protrusive excursions were examined. In addition, the subjects' occlusal schemes were classified according to the definition from Glossary of Prosthodontic Terms (8th edition) as well as the presence of occlusal interferences during mandibular excursions. Discrepancy between retruded contact position (RCP) and intercuspal position (ICP) was also performed.

Results: The majority of the populations with physiologic occlusion had total number of existing teeth of 28 and Angle's classification class I. The mean vertical overlap and horizontal overlap were 1.88 ± 1.25 and 2.33 ± 1.31 mm respectively. The average maximum mouth opening, left and right excursive / protrusive movement was 46.52 ± 4.57 , 8.77 ± 1.3 , 8.55 ± 1.23 , and 6.28 ± 1.55 mm respectively. The most common occlusal scheme was group function. Occlusal interference was presented in 20.2% of the population. The most common occlusal interference was protrusive interference (12.1%). About 80% possessed no RCP-MIP discrepancy with the average of 0.15 ± 0.3 mm.

Conclusions: The common occlusal characteristics of physiologic occlusion among Thais are group function occlusal scheme, Angle's classification I, absence of occlusal interference, approximate 45 mm of maximum mouth opening and absence of RCP-ICP discrepancy.

Key words: dental occlusion, dynamic occlusion, masticatory system, occlusal scheme, static occlusion

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Introduction

Dental occlusion has been an essential part of all dental specialties. When performing any kind of restorative works, dentists should deliver these dental works back into the patients' mouth while imposing minimal adaptation demands on the jaw system. Dental prostheses in normal dental patients should not cause more difficulties for patient's envelope of motion (particularly the contact movement component) to fit it on and should not introduce new interferences.

However, in clinical practice dentist cannot always construct or alter patient's occlusion to theoretically ideal occlusion to minimize the adaptation demands of masticatory system. The ideal occlusion is defined as the preconceived theoretical concept of occlusal structural and functional relationships that includes idealized principles and characteristics that an occlusion should have¹. However, ideal occlusion does not represent the norm in a statistical sense and only occasionally represent the occlusal characteristics of any given individual.

For this reason, concept of physiologic occlusion has become a practical concept in restorative dentistry. In 1988 Mohl has described the criteria for a physiologic occlusion as the following:

1. Occlusal stability: teeth should stay in position without a tendency to extrude, drift, rotate, or otherwise migrate within a dentition. The slow, compensatory, physiological movement or adaptation that accompanies wear at contact areas in order to maintain the continuity of the arch, or passive eruption to maintain occlusal contact in the presence of a normal rate of attrition, are to be expected and are acceptable. Migration beyond this (i.e., occlusal instability) is not acceptable.

2. Masticatory function is satisfactory to the patient. This is a subjective assessment on

the part of the patient. If a patient can meet his or her own masticatory and dietary needs, the situation is considered physiological.

3. Speech articulation is acceptable to the patient. This is also a subjective assessment. An impaired speech sound resulting from a malocclusion may be considered physiological if the patient has no concern about this situation

4. Esthetic considerations are acceptable to the patient. This is obviously a completely subjective assessment and must be left entirely to the patient.

5. Freedom from signs or symptoms involving the periodontal attachment apparatus that are related to functional loading. Clinically detectable fremitus or mobility of teeth not directly attributable to the inflammatory process resulting from periodontal disease should be regarded as functional in nature. A physiologic occlusion precludes this phenomenon, particularly if such fremitus or mobility are progressive.

6. Freedom from signs and symptoms of conditions involving the teeth themselves that are attributable to functional activity. Thus, a physiologic occlusion would preclude such conditions as excessive attritional patterns from parafunctional activities or from a very abrasive diet.

7. Freedom from signs and symptoms involving the temporomandibular joint or the musculature associated with mandibular function. Although a physiologic occlusion, by definition, may not exhibit such signs or symptoms, their presence does not necessarily imply that the cause is in faulty occlusal or maxillomandibular relationships. It merely suggests that the overall situation is not physiological, and that some type of therapy may be indicated.

For the field of restorative dentistry especially during the process of oral

rehabilitation, the principle of physiologic occlusion should be adhered. However, the occlusal characteristics of physiologic occlusion among Thai population were not well illustrated. For this reason, the purpose of this study was an attempt to depict static and dynamic occlusal relationship among Thais as a descriptive occlusal characteristic of physiologic occlusion.

Material and methods

The population for this study consisted of 124 subjects attending clinic at Faculty of Dentistry, Mahidol University (49 males and 75 females) who met the criteria for physiologic occlusion by Mohl¹ previously described were selected.

The static and dynamic occlusal relationship of each subject was assessed by intraoral examination on a dental chair under direct vision and by the same operator in the same period of the day (morning hours) to avoid possible diurnal variation.² Static occlusal relationship included number of occluding teeth, the incisor relationship (vertical and horizontal overlap), and Angle's classification. The examination of dynamic occlusal relationship comprised of the distance of maximum mouth opening, maximum left and right lateral excursion as well as protrusion, occlusal scheme, occlusal contacts/interferences in excursive movements on the working and the nonworking side and distance of RCP-ICP discrepancy/slide. Shimstock (Almore shimstock, 8 mm wide, 8 µm thick, Hanel, Langenau, Germany) was used to confirm tooth contact³.

For occlusal contacts/interferences in excursive movements, subjects were asked to perform the movements with the aid of a handheld mirror. The shimstock was placed on the occlusal surfaces of teeth from the canine backward; the subject was then asked to close

his/her mandible into maximum intercuspation. Gliding movement was performed to the right or the left while the examiner maintained a constant pulling force on the shimstock; on reaching the 0.5 mm position, the teeth holding the shimstock were recorded as working side contacts. The subject was asked to repeat the movement with the shimstock placed on the opposite side to record nonworking side contact. Occlusal contacts at the protrusive excursion of mandibular movement were recorded at the edge-to-edge position. The shimstock was placed on the incisal edges of the anterior teeth; the subject was asked to close into maximum intercuspation and then slide to the edge-to-edge protrusive position while the examiner maintained a constant pulling pressure. Once the teeth were at the edge-to-edge position, teeth holding the shimstock were considered to be in contact and were recorded. The shimstock was then placed on the occlusal surfaces of posterior teeth, and the subject was asked to repeat the same movement to check for the presence of posterior tooth contact.

For the RCP and ICP discrepancy, we examined the difference between the two occlusal positions by closing the mandible in its rearmost (and uppermost) position by manual guidance until the first contact is established. This is the retruded contact position (RCP). If the patient is then asked to squeeze the teeth together, a forward movement, sometimes with a lateral component, allows the mandible to slide towards the intercuspal position (ICP). The antero-posterior distance of the discrepancy was measured at the incisors in millimeters.

Results

Total of 124 subjects (60.5% female, age 17 – 50 years old) were included in this study. The details of demographic data and several occlusal characteristics are shown in table 1.

The average number of teeth per subject was 28.98 ± 1.3 . About 80% possessed Angle classification I. The average distance of vertical overlap and horizontal overlap were 1.88 ± 1.25 and 2.33 ± 1.31 mm. respectively

Table 2 and 3 illustrated the details of static and dynamic occlusal relationship respectively. The majority of the populations (69.4%) possessed group function occlusal scheme. We also found that occlusal

Table 1 Demographic and several occlusal characteristics of the studied population

Age	Average:	25 y.
	Minimum:	17 y.
	Maximum:	50 y.
Gender	Male:	39.5 %
	Female:	60.5 %
Occlusal scheme (% of total N)	Group function:	69.4%
	Canine protected occlusion:	17.7%
	Combination:	7.3%
	Unclassified:	5.6%
Angle's classification	Class I	82.3%
	Class II	0%
	Class III	15.3%
	Unclassified	2.4%
Presence of occlusal interferences (% of total N)	No interference	79.8%
	Balancing interference	7.3%
	Working interference	0.8%
	Protrusive interference	12.1%
RCP-ICP discrepancy (% of total N)	Absence (RCP-ICP coincidence)	77.4%
	Presence (0.5-1 mm)	22.6%

Table 2 Static occlusal characteristics of the studied population

	Minimum	Maximum	Mean \pm SD*	Mode
Vertical overlap (m.m.)	0	6.00	1.88 ± 1.25	1.00
Horizontal overlap (m.m.)	0	7.50	2.33 ± 1.31	2.00
Total numbers of teeth	28	32	28.98 ± 1.30	28.00

*SD = standard deviation

Table 3 Dynamic occlusal characteristics of the studied population

	Minimum	Maximum	Mean \pm SD*	Mode
Maximum mouth opening [#]	36.00	56.00	46.52 ± 4.57	45.00
Left lateral excursion [#]	6.00	11.00	8.77 ± 1.30	9.00
Right lateral excursion [#]	6.00	11.00	8.55 ± 1.23	8.00
Protrusion [#]	2.00	10.00	6.28 ± 1.55	7.00
RCP-ICP Discrepancy [#]	0	1.00	0.15 ± 0.30	0

*SD = standard deviation

[#] measured in millimeters (mm.)

interference was presented in 20.2% of the population. The most common occlusal interference was protrusive interference (12.1%). The average maximum mouth opening was 46.52 ± 4.57 mm. The average distance of left and right excursive movements were 8.77 ± 1.3 , 8.55 ± 1.23 mm. There was no statistically significant difference between the distances of left VS right excursive movements. The protrusive movement was 6.28 ± 1.55 mm. The majority (77.4%) has coincide of RCP-ICP position. The average antero-posterior distance of RCP-ICP discrepancy was 0.15 ± 0.3 mm

To demonstrate the “central tendency” of the data or the most commonly found value in several occlusal characteristics among the patients with physiologic occlusion, we decided to express the result of several continuous occlusal characteristic data in “mode”. The mode is the value that appears most often in a set of data. We found the mode for vertical overlap was 1.00 mm, for horizontal overlap was 2.00 mm, and for the total number of teeth was 28. The mode for maximum mouth opening was 45 mm. Left/right lateral excursion and protrusion were 9.00, 8.00, and 7.00 mm. respectively. Lastly, the mode for RCP-ICP discrepancy was 0.00 mm.

Discussion

In this study, we attempted to characterize the occlusal relationship in population possessing physiologic occlusion. Physiologic occlusion is essential for functional comfort which neuromuscular harmony prevails in the masticatory system and sometimes described as normal occlusion⁴. This study only focused on anatomical aspect of the physiologic/normal occlusion.

First for static occlusion, the result showed that the common number of teeth was 28. This agreed with the suggestion by Helkimo's 1974⁵ original occlusal index indicating that the

number of teeth between 28-32 was considered as the lowest score of 1 (3-point score system). The high total score of Helkimo index may indicate the higher risk of temporomandibular disorders^{6,7}. Other static occlusal characteristics such as Angle's classification, Angle's classification I is the most commonly found in our study. This is in agreement with general believe in dental practice considering this as normal occlusion^{8,9}.

We found that majority of studied population with physiologic occlusion possessed group function occlusal scheme. This is similar to the earlier epidemiological data such as study by Beyron¹⁰ showed quite conclusively that adult Australian aborigines had group function occlusion. However, the study did not indicate whether their subjects fulfilled physiologic occlusion or not.

For the occlusal interference, The sixth edition of the glossary of prosthodontic terms¹¹ defines an occlusal interference as any tooth contact that inhibits the remaining occluding surfaces from achieving stable and harmonious contacts. Ash and Ramfjord (1995)⁴ described the term occlusal interference as an occlusal contact relationship that interferes in a meaningful way with function or parafunction. Our study found that majority of the population do not process occlusal interferences. The type of occlusal interferences that has the highest percentage is protrusive interference following by balancing side interference. This is surprising that our finding was less than others which the most common interference was balancing or non-working interference.

The result of the incisal relation found from this study was similar with previous study in Thai population. They found the common range of vertical overlap was 1-3 mm. and the horizontal overlap was 2-4 mm.¹² This finding was similar to our finding. Interestingly, we found that the lesser distance of vertical

overlap or overbite was found in the population with protrusive interference.

A number of limitations can be noted in the above mentioned studies: No reference was made to the location of the canine in terms of its relationship to the line of the arch nor to the degree of attrition of the canine, which is of particular importance in examining the assumption that attrition could lead from one type of contact during lateral movement to another¹³. In this study, subjects with marked attrition were excluded based on the assumption made by McAdam¹⁴ and Woda et al¹³ that canine guidance and group function appear to correspond to two successive states of the evolving dentition under the effect of attrition.

Moreover, the position at which the occlusal contact pattern was recorded (cusp to cusp) may not be representative of the functional range of the lateral excursion of mandibular movement. Chewing kinematics can vary based on several factors such as age, dental static occlusion, facial morphology, and so on.^{15,16}

Another fact for consideration is that changes occurring during the development of occlusion could influence the occlusal contact pattern; Heikinheimo et al¹⁷ reported an increase in occlusal interferences between the ages of 12 and 15 years; other studies showed a decreasing prevalence with increasing age.^{13,18,19} The fact that the sample was composed of subjects aged 18 to 50 years, this could be the explanation for the slight differences in the result from other studies as the changes occurring during occlusal development could influence the occlusal contact pattern.

For natural dentition, there is a common believe in the existence of a short path of movement between the RCP and the ICP in an antero-posterior direction. Both occlusal positions are used frequently during function. Numerous studies have shown that a

discrepancy of 0.5–1.5 mm exists between these positions in adults²⁰⁻²³

Coincidence of the RCP and the ICP was found in 22 per cent of the sample examined by Shefter and McFall (1984)²⁴ and one-third of the patients investigated by Solberg et al. (1979)²⁵, but in only 12 per cent of the sample used by Posselt (1952)²² and 8 per cent of a group studied by Reynolds (1970)²⁶. Whereas in our study we found almost 80% of our population has the coincidence. This maybe due to the variation in methods for the CR manipulation^{27,28} used in each study.

In conclusion, this study demonstrated that among Thais, the most common occlusal scheme is group function, however there was no demographic or occlusal factors that strongly related to any particular occlusal scheme. However, we did not focus our study on the exact association between other static occlusal relationship parameters such as Angle's classification with the other dynamic occlusal relationship parameters other than occlusal scheme. This should be conducted in the future study.

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