

A Clinical Study to Determine the Pattern of Occlusal Contacts in Lateral Positions and Its Validity in Classifying Guidance Patterns

Anit Singh · Rajashekar Sangur · B. Lakshmana Rao ·
Tanu Mahajan

Received: 25 September 2011 / Accepted: 18 October 2012 / Published online: 9 November 2012
© Indian Prosthodontic Society 2012

Abstract The existing classification systems like canine-guided and group function are insufficient to classify all clinical conditions and chances of subjective variations are always there, as there is no standardization in examination method. Hence a study was planned to find out the frequency of tooth contacts in different lateral positions and to assess whether existing occlusal schemes like canine protection and group function can classify all occlusal guidance in the natural dentition. 100 systematically healthy undergraduate students between the age group of 18 to 25 years were selected. Occlusal contacts were examined with shim stock in lateral positions, 0.5, 1, 2, and 3 mm from the maximum intercuspation. Frequency of tooth contacts in different lateral positions was examined. The SPSS version 15.0 statistical software and Chi-Square test were used for statistical analysis. Out of all the four lateral positions, 0.5 mm position showed maximum contacts which progressively decreases for further positions. Out of all teeth, canine showed consistent contact frequency throughout all four positions. Most contact patterns belonged to group function, and a few to canine protection. Majority of the contact patterns were those other than canine protection and group function and were unclassifiable. On the basis of the results of this study, it does not seem appropriate to describe and classify the patterns of occlusal contact using only existing classification system. A clear description regarding the position of mandible should be included in definition for research as well as clinical situations. Here an attempt is made to classify eccentric occlusal contact at different lateral positions so as to get consistent result for future studies.

Keywords Canine guided occlusion · Group function occlusion · Occlusal registration strips · Occlusal contact pattern

Introduction

Establishing or providing occlusion that successfully permits efficient masticatory function is basic to dentistry and survival.

The long-term stability of the posterior teeth is dependent on the anterior teeth not wearing away or moving, so it is important to establish an anterior guidance that does not interfere with either the neutral zone or the natural envelope of function through all excursive pathways [1].

The collective arrangement of the teeth in function is quite important and has been subjected to a great deal of analysis and discussion over the years. There are three recognized concepts that describe the manner in which teeth should and should not contact in the various functional and excursive positions of the mandible. They are bilateral balanced occlusion, unilateral balanced occlusion, and mutually protected occlusion.

Bilateral balanced occlusion is a concept that is not used as frequently today as it has been in the past. It is largely a prosthodontic concept which dictates that maximum number of teeth should contact in all excursive positions of the mandible. This is particularly useful in complete denture construction.

Group function and canine protection have been used as categories for classification of the patterns of occlusal contacts in lateral excursions in natural dentition [2, 3].

In the glossary of prosthodontic terms, Group function is defined as “multiple contact relations between the maxillary and mandibular teeth in lateral movements on the

A. Singh · R. Sangur (✉) · B. L. Rao · T. Mahajan
Department of Prosthodontics, Rama Dental College-hospital &
Research Centre, A/1-8, Lakhapur, Kanpur 208024, UP, India
e-mail: rsangur@yahoo.co.in

working side.” Canine protection is defined as “a form of mutually protected articulation in which the vertical and horizontal overlap of the canine teeth disengages the posterior teeth in the excursive movements of the mandible.”

The occlusal contact pattern varies according to the mandibular position examined. There is no description regarding the mandibular position when examining occlusal contacts, which may account for the inconsistencies among the findings of the previous studies. Currently, no clear description of the mandibular position for the examination of occlusal contacts has been defined (Glossary of Prosthodontic Terms, 1994). Lack of a standardized mandibular position could lead to inconsistent results in assessing occlusal contacts. The conflicting findings regarding the role of occlusal contacts in temporomandibular disorders, bruxism and periodontal disease could have been caused, in part, by inconsistencies in the examination method [4, 5]. The primary hypothesis advanced in this study is that the contact pattern varies with the mandibular position. If this proves to be true, then the influence of the mandibular position on occlusal contacts should be defined. Unless lateral positions are studied, future advancement in understanding the roles of occlusal contacts in mandibular function and dental diseases is limited.

Hence, this study is planned to evaluate the use of canine protection and group function in classifying occlusal guidance in the natural dentition.

Materials and Methods

The present study consisted of 100 systematically healthy subjects as study samples between the age group of 18 to 25 years. They are selected from undergraduate students in the first, second, third and fourth year of the faculty of dentistry.

The inclusion criteria were:

(1) Normal occlusal alignment with Angle’s class I relationship. (2) Full dentition except for third molars. (3) No history of orthodontic therapy. (4) No restorations involving a cusp. (5) No temporomandibular disorder. (6) No attrition.

The exclusion criteria were:

(1) Carious teeth involving cusp. (2) Severe attrition. and (3) Subjects requiring orthodontic treatment. Informed consent was obtained from each subject before the commencement of the investigation.

Materials

The oral examination of the subjects was carried out using mouth mirror.

Armamentarium (Fig. 1)

- (1) Shim stock occlusal registration strips of 12 micron thick [Arti-Fol metallic articulating film—Dr. Jeau Baugh KG, Germany (Lot no. 77002 P 15)].
- (2) Stainless steel scale.
- (3) Marker pen.
- (4) Mosquito forceps (KSK).

Methodology for Recording of Occlusal Contacts

Each subject was required to sit upright in a dental chair with the Frankfurt horizontal plane parallel to the floor. The subject’s head was not fixed. The interocclusal contacts were recorded with shim stock (12 μ m thick) in four lateral positions on both sides; 0.5, 1, 2, and 3 mm from the maximum intercuspation. To regulate each lateral position, marks were made on the maxillary central incisors with a marker pen to the right of the mandibular midline. The shim stock was placed on the occlusal surface of the right side, most posterior mandibular molar, and the subject was requested to close his/her mandible to the maximum intercuspation. While a constant pulling force is maintained on the shim stock, the subject was requested to perform a habitual gliding movement to the right with the teeth in light contact. When the subject’s mandible was moved 0.5 mm right from the intercuspal position, the presence or absence of an occlusal contact was examined (Fig. 2). The teeth holding the shim stock were considered to have occlusal contact. To prevent the movement with mandibular opening and without any occlusal contact and lateral protrusive excursion, the movement was observed, and occasionally the subject was instructed to correct the movement. The movement was performed by the subject without any help from the examiner. When the subject could not perform the movement voluntarily, he or she was



Fig. 1 Armamentarium for the study

Fig. 2 Guiding the patient to lateral position at 0.5 mm with shim stock in place and marking of lateral positions



Fig. 3 Guiding the patient to lateral position at 1.0 mm with shim stock in place and marking of lateral positions



Fig. 4 Guiding the patient to lateral position at 2.0 mm with shim stock in place and marking of lateral positions



asked to practice with the use of a hand mirror. The examination was continued from the right side, most posterior molar to the one on the left side. For the examination of the molars, the shim stock was placed on both mesial and distal sites of the occlusal surface. The same procedure was performed in the 1 mm, 2 mm, 3 mm right position and 0.5, 1, 2, 3 mm left positions (Figs. 3, 4, 5).

Results

In the present study, a total of 100 subjects were taken as a study group covering the age range of 18 to 25 years. The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 15.0 statistical Analysis Software and Chi-Square test were used to get the probability level and the values were represented to know the significance.

Table 1 and Bar diagram 1 shows the contact frequency at different lateral positions on right side, Out of all the four lateral positions, 0.5 mm lateral position showed maximum contacts which progressively decreases for further lateral positions. Out of all teeth, canine showed consistent contact frequency throughout all four positions. Whereas 1st premolar and 2nd premolar showed significant decrease in the contact frequency through lateral positions from 1 to 2 mm and 0.5 to 1 mm respectively.

Table 2 and Bar diagram 2 shows the contact frequency at different lateral positions on left side. Out of all the four lateral positions, 0.5 mm lateral position showed maximum contacts which progressively decreases for further lateral positions. Out of all teeth, canine showed consistent contact frequency throughout all four positions, whereas both 1st premolar and 2nd premolar showed significant decrease in the contact frequency through lateral positions from 1 to 2 mm.

Fig. 5 Guiding the patient to lateral position at 3.0 mm with shim stock in place and marking of lateral positions

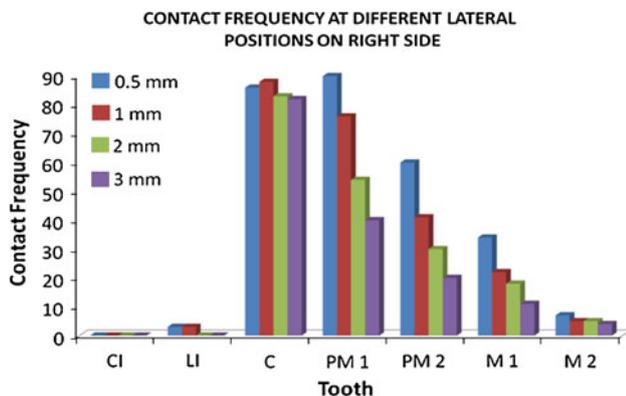


Table 1 Contact frequency at different lateral positions on right side

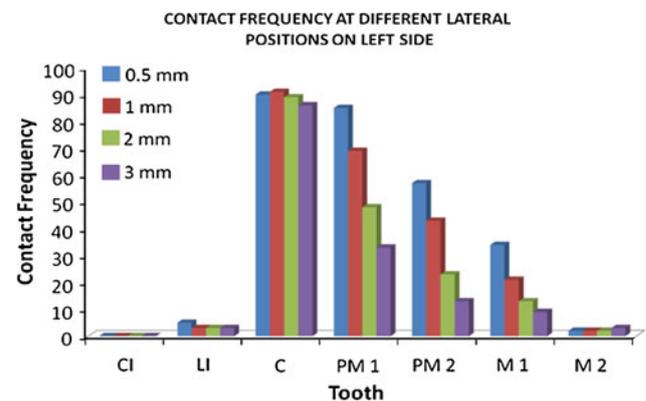
S. no.	Tooth	0.5 mm	1 mm	2 mm	3 mm
1.	CI	0	0	0	0
2.	LI	3	3	0	0
3.	C	86	88	83	82
4.	PM 1	90	76	54	40
5.	PM 2	60	41	30	20
6.	M 1	34	22	18	11
7.	M 2	7	5	5	4
Total		280	235	190	157

Table 2 Contact frequency at different lateral positions on left side

S. no.	Tooth	0.5 mm	1 mm	2 mm	3 mm
1.	CI	0	0	0	0
2.	LI	5	3	3	3
3.	C	90	91	89	86
4.	PM 1	85	69	48	33
5.	PM 2	57	43	23	13
6.	M 1	34	21	13	9
7.	M 2	2	2	2	3
Total		273	227	178	147



Bar Diagram 1 Contact frequency at different lateral positions on right side

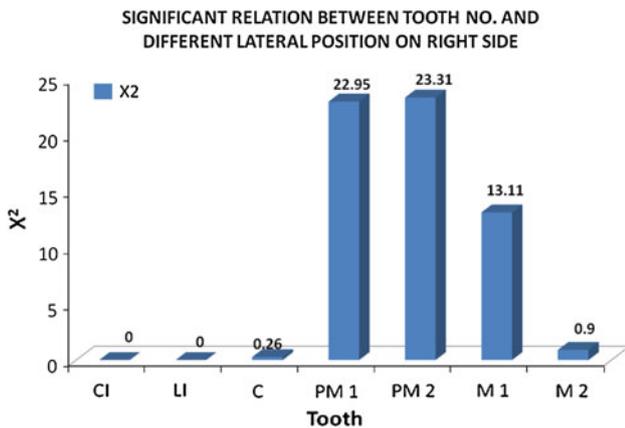


Bar Diagram 2 Contact frequency at different lateral positions on left side

Table 3 and Bar diagram 3 shows the significant relation between tooth and different lateral position on right side. On comparing the data statistically, central incisor, lateral incisor and canine showed Chi-Square test value as 0, 0 and 0.26 respectively giving probability level value more than 0.05, which is non-significant. First premolar, second premolar and first molar showed Chi-square value as 22.95, 23.31 and 13.11 respectively giving probability level value of less than 0.05, which is significant in tooth contact frequency. For second molar Chi-Square value was 0.90 giving probability level value more than 0.05, which is non-significant.

Table 3 Significant relations between tooth no. and different lateral position on right side

S. no.	Tooth no.	X ²	P	Significance
1.	CI	0	0	Non significant
2.	LI	0	0	Non significant
3.	C	0.26	>0.05	Non significant
4.	PM 1	22.95	<0.05	Significant
5.	PM 2	23.31	<0.05	Significant
6.	M 1	13.11	<0.05	Significant
7.	M 2	0.90	>0.05	Non significant



Bar Diagram 3 Significant relations between tooth no. and different lateral position on right side

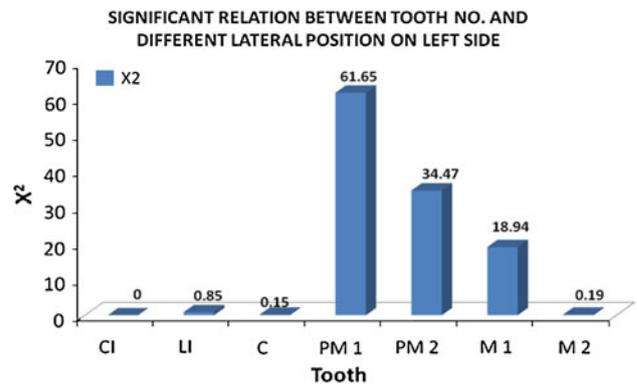
Table 4 Significant relations between tooth no. and different lateral position on left side

Sl. No.	Tooth no.	X ²	P	Significance
1.	CI	0	0	Non significant
2.	LI	0.85	>0.05	Non significant
3.	C	0.15	>0.05	Non significant
4.	PM 1	61.65	<0.05	Significant
5.	PM 2	34.47	<0.05	Significant
6.	M 1	18.94	<0.05	Significant
7.	M 2	0.19	>0.05	Non significant

Table 4 and Bar diagram 4 shows the significant relation between tooth and different lateral position on left side. On comparing the data statistically, central incisor, lateral incisor and canine showed Chi square test value as 0, 0.85 and 0.15 respectively giving probability level value more than 0.05, which is non-significant. First premolar, second premolar and first molar showed Chi-square value as 61.65, 34.47 and 18.94 respectively giving probability level value of less than 0.05, which is significant in tooth contact frequency. Second molar showed Chi-Square values as 0.19 giving probability level value more than 0.05, which is non-significant.

Discussion

Canine protection and group function have been used as categories for classification of the patterns of occlusal contacts in lateral excursions in natural dentition. Several studies have noted the prevalence of these two types of occlusal guidance and the relationship between the occlusal contact pattern and mandibular function. The relationship between the occlusal contact pattern and mandibular function includes the effect of occlusal contact on



Bar Diagram 4 Significant relations between tooth no. and different lateral position on left side

mandibular movement, on masticatory muscle activity, on the forces in the temporomandibular joint, and on the signs and symptoms of temporomandibular disorders (TMD). However, there are conflicting findings among these studies, due in part to the variations in the definitions and systems used to describe and classify the occlusal contact pattern. However, the occlusal contact pattern varies according to the mandibular position examined. There is no description regarding the mandibular position when examining occlusal contacts, which may account for the inconsistencies among the findings of the previously done studies.

In many studies of occlusal contact patterns, the occlusal contacts have been recorded in an edge-to-edge position of the canines approximately 3 mm lateral from the maximum intercuspation, or in an unregulated position. Because this position is rarely used during mastication except in incising food and in parafunction such as bruxism, the present study investigated the pattern of occlusal contact in regulated positions in the range of 1 to 3 mm from the maximum intercuspation. However, it is highly possible that the occlusal contact during mastication occurs only within the 1 mm lateral position, depending on the person. Yaffe and Ehrlich [6] suggested that occlusal gliding contact during mastication would occur in the 0.5 mm position and that the occlusal contact pattern in this position must be evaluated when investigating the role of occlusal contact on masticatory function. Therefore, in this study, occlusal contacts were examined in lateral positions from 0.5 to 3 mm, namely, the functional region to parafunctional region in the masticatory system.

Understanding the usefulness of the available examination methods for diagnosis requires a working knowledge of the reliability of clinical measurement. A comparative study has shown that shim stock has better reliability than articulating film for examining occlusal contacts, and that shim stock provides acceptable reliability in the clinical measurement of occlusal contacts [7]. To obtain the reliability of contact recording, the current study standardized the factors that affect the results of occlusal

contact, such as diurnal effects [8]. The current method that used shim stock seemed to have acceptable reliability for examining occlusal contacts during lateral excursion.

The interpretation of canine protection and group function as classification categories is relatively easy. In short, canine protection is a single tooth contact pattern on the working side canine throughout lateral excursion. Group function is a contact pattern on two or more working side teeth throughout lateral excursion. The only problem with these definitions is the absence of a description for the position of mandible. The question thus arises as to which category is appropriate when the occlusal contact exists on the working side first premolar in the total range of positions from 0.5 to 3 mm, and when the contact exists on the canine, first and second premolars at the 0.5 mm position and only canine contacts at 2 mm position. In light of the given definition, canine guided and group function appears to imply an ideal therapeutic occlusion and is not a usable description for an existing contact pattern. In this study, lateral excursion was divided into four stages to reflect the total range of occlusal contact. On the working side, the prevalence of contact on canines was increased, and simultaneously, the prevalence of contact on premolars and molars decreased with increasing deviation of the mandible from the maximum intercuspation. The patterns that were impossible to classify were contact patterns on only a working side incisor, a premolar, or a molar throughout the total lateral positions. The question thus arises as to which category is appropriate when the occlusal contact exists on the working side first premolar in the total range of positions from 0.5 to 3 mm, and when the contact exists on the canine, first and second premolars at the 0.5 mm position and only canine contacts at 2 mm position. Because most of the contact patterns could not be classified as group function, and the guidance patterns other than canine protection and group function existed in most cases, the validity of classification system using canine protection and group function is therefore questionable. A classification system that reflects other functional characteristics would provide useful and valuable information to dentists and researchers. Because of uneven grouping, it is difficult to make a random sampling and equalize the groups with the current classification system of canine protection and group function. In addition, this system provides no information concerning the details of the group-function group and how the unclassifiable patterns should be dealt with. The findings in this study revealed a large group of contact patterns that were unclassifiable by the system categorizing guidance patterns that used only canine protection and group function. A new classification system of occlusal guidance should be established; otherwise, any theory regarding prosthetic treatment and/or occlusion will be ambiguous. Nevertheless, a precise and reproducible method for determining the occlusal contact and classifying the occlusal contact patterns has not been established yet.

The establishment of a new classification system for occlusal contact pattern could resolve these disagreements and clarify the impact of the occlusal contact patterns that contribute to the success of restorative dentistry and in the prevention and treatment of TMD.

New Classification of Occlusal Contact Patterns

In order to get consistent result with the studies related to stomatognathic system particularly that of mandibular function and movement, a precise and reproducible system for evaluating occlusal contacts is needed for the investigation of the effect of occlusal contacts on mandibular function. Here an attempt is made to classify occlusal contact schemes so as to get the consistent result for future studies.

This system classifies right and left positions separately. For example, for right side occlusal contacts at 1 mm position it's RT 1. Same ways for left side 3 mm position it's LT 3.

Classification

Class I: Contact pattern on working side only

Division 1: Single tooth contact

Division 2: Group function

Class II: Contact pattern on working as well as non-working side

Division 1: Single tooth contact on working side along with

Subdivision A: Single tooth non working interference

Subdivision B: Multiple non working interference

Division 2: Group function on working side along with

Subdivision A: Single tooth non working interference

Subdivision B: Multiple non working interference

Example 1: RT 3—Class II—Division 1A

It denotes right side position at 3 mm single tooth contact on working side along with single tooth non working side interferences

Example 2: LT 1—Class I—Division 1

It denotes left side position at 1 mm with single tooth contact on working side only

Example 3: RT 1—Class II—Division 2B

Denotes right side position at 1 mm group function on working side along with multiple non working side interferences

Conclusion

Canine protection and group function have been used when describing occlusal contact patterns during lateral excursion and are simple and useful concepts to outline the occlusal guidance pattern. However, much confusion and inconsistency has accompanied the interpretation of these terms. On the basis of the results of this study, it does not seem appropriate to describe and classify the patterns of occlusal contact using only existing classification system in clinical and research fields. Existing classification schemes like canine guided and group function schemes are insufficient to classify majority of cases. A clear description regarding the position of mandible, including a clear and modified definition of canine guided and group function occlusal schemes is needed for not only research purpose but also for clinical study. Here an attempt is made to classify eccentric occlusal contact at different lateral positions so as to get consistent result for future studies.

References

1. Dawson PE (2007) The envelope of function. Functional occlusion from TMJ to smile design, 1st edn. Mosby Elsevier, Canada, pp 141–148
2. Ogawa T, Ogimoto T, Koyano K (1998) Pattern of occlusal contacts in lateral positions. Canine protection and group function validity in classifying guidance pattern. *J Prosthet Dent* 80:67–74
3. Ogawa T, Ogimoto T, Koyano K (2001) The relationship between non-working side occlusal contacts and mandibular position. *J Oral Rehab* 28:976–981
4. Ingervall B, Hahner R, Kessi S (1991) Pattern of tooth contacts in eccentric mandibular positions in young adults. *J Prosthet Dent* 66:169–176
5. Ingervall B, Meyer D, Stettler B (1992) Tooth contacts in eccentric mandibular positions and facial morphology. *J Prosthet Dent* 67:317–322
6. Yaffe A, Ehrlich J (1987) The functional range of tooth contact in lateral gliding movements. *J Prosthet Dent* 57:730–733
7. Takai A, Nakano M, Bando E, Hewlett ER (1993) Evaluation of three occlusal examination methods used to record tooth contacts in lateral excursive movements. *J Prosthet Dent* 70:500–505
8. Berry DC, Singh BP (1983) Daily variation in occlusal contacts. *J Prosthet Dent* 50:386–391