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Original Article

Effect of Body Position on the Pattern of Occlusal Contacts during Lateral Excursions in Undergraduate Students at Sardar Begum Dental College, Peshawar

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Abstract

Background: Occlusal contacts have a critical role in maintaining the stability and functionality of the masticatory system. Despite the recognized importance of occlusal contacts in Maximum intercuspation and lateral excursion, there is limited understanding of variations in body position affecting these occlusal contacts and the most common pattern of occlusal contact during lateral excursion.
Objective: To determine the frequency of different patterns of occlusal contacts and to evaluate the effect of body position on them during lateral excursions in undergraduate students at Sardar Begum Dental College, Peshawar.
Methods: This cross-sectional study was carried out at Sardar Begum Dental College, Peshawar from November 2021 to January 2022. Participants fulfilling the inclusion criteria were positioned in upright, 45 degree and supine position of dental chair and instructions were given to perform lateral excursive movement from maximum intercuspation to the end-to-end position of canines. Occlusal contact during lateral movement of mandible was checked using shim stock held by Miller forceps.
Results: As per pattern of occlusal contacts, 56 (54.36%) participants had canine guidance, 3 (2.91%) participants had anterior guidance through incisors while 44 (42.71%) participants had group function. Alterations in body position led to variability in occlusal contacts, with the supine position showing the greatest number of shifts between canine guidance and group function. However, these changes were not statistically significant (p =0.15 on the left, p =0.16 on the right).
Conclusion: It has been concluded that most of the contact pattern were canine guidance, followed by group function and anterior guidance through incisors during lateral excursions. The number of dynamic occlusal contacts in most subjects were altered with change of the body position.
Key words: Canine guided, group function, anterior guidance.

Introduction

Successful and predictable masticatory efficiency depends on smooth, harmonic, and synchronized mandibular movements.[1] The factors that determine mandibular movements are the Temporomandibular joint (TMJ), muscles and teeth.[2] Among these, the teeth play significant role in mandibular movements in centric as well as eccentric positions. The factors guiding the mandible in different directions are tooth height, tooth width, their occlusal morphology, occlusal plane and tooth position in maxillary and mandibular arch.[3]

The design and positioning of occlusal contacts in both natural and artificial dentition define the occlusal scheme of an individual. The occlusal schemes found are canine guided occlusion/ Mutually protective occlusion, Group function and Balanced occlusion.[4]

Occlusal scheme mostly adopted for rehabilitating patients in dynamic occlusion are canine guided and group function.[5] With age,

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MA, MAC & MK conceptualized the project. MA & MR did the data collection and performed the statistical analysis. MA, JA & HIM did the literature search. Drafting, revision & writing of manuscript were done by MA, MAC, MK & HIM.

because of tooth wear occlusal scheme may change from one form to another. Canine guided occlusion is considered the preferred occlusal scheme in most of the studies. However, this occlusal scheme is not present in early dentition before 12 years of age. According to other researchers, no single occlusion pattern predominates in nature, and each occlusal scheme has advantages and disadvantages of its own due to varying loading patterns.[6] Life has biological variation as a feature. While some genetic variants are environmental and impact specific tooth form, morphology, and function, others are generic in the dentition. Nonetheless, the mandibular position also influences pattern of occlusal contact. The lack of information on the mandibular position during occlusal contact examination may be the cause of the discrepancies between the results of earlier research.[7]

Occlusal contacts change with change in body position. According to a study, posture has an impact on occlusal stability since the center of occlusal force (COF) trajectory length was greater while standing than when sitting or lying down.[8] For prosthodontic rehabilitation canine-protected occlusion is selected because of reduced stresses on the posterior teeth by many clinicians .[9] Statistics, however, indicate that group function is more common than any other occlusion pattern, as observed by Aslam K.[10]

Data on the subject matter is not available locally and scarce internationally. Therefore, the purpose of present study is to evaluate the most prevalent pattern of occlusal contacts and the effect of the body position on the pattern of occlusal contacts in lateral excursions. By evaluating these patterns, we aim to enhance understanding of occlusal dynamics for practical setting, contributing to both educational frameworks and clinical protocols.

Methods

This descriptive cross-sectional study was conducted at the Department of Prosthodontics, Sardar Begum Dental College, Peshawar from November 2021 to January 2022. Sample size was 103, using a 96% proportion of dynamic occlusal contacts [11], at 95% confidence level and a 3.8% absolute precision using WHO software for sample size determination. The Sampling technique was Consecutive Non-probability Sampling. Undergraduate students, 20-30 years of age with dentate arches (except for third molars) having occlusion with Angle's class I relationship were included in the study whereas those with the history of restorations involving cusps, carious teeth involving cusps, teeth with attrition and erosion and dentition needing orthodontic treatment were excluded from the study.

Participants were formally invited to the study after explaining the objectives, duration, and course of the study. They were assured that their personal data and other information would be kept confidential. Informed consent and data collection from each participant were obtained through a standardized self-structured proforma. Those who met the inclusion criteria were positioned in the dental chair (Figure-1), and instructions were provided to execute lateral excursion (excursive movement from maximum intercuspation to the position where the canines align in an edge-to-edge configuration). To verify these contacts during lateral excursion, shim stock secured by Miller forceps was utilized. The contacts on both the working and non-working sides were assessed and recorded. Utilizing the method outlined by Ogawa et al., the occlusal contacts at the initial and final stages of the excursion were identified. To avoid errors and ensure intra-observer reliability, a protractor was placed on the hinge portion of the dental chair, along with a scale to accurately mark the angles. In order to fulfil this requirement, the angle of the dental chair's back was adjusted so that the subjects' Frankfort plane was positioned at different angles relative to the protractor: upright, 45 degrees, and supine. In every position, the headrest served to support the head, which, in turn, helped to prevent tension in the supra- and infra-hyoid muscles.[3] Data collection was conducted for three separate body postures (Figure 1), namely the upright body position (The backrest of dental chair was considered upright when the subjects' Frankfort plane becomes horizontal at 0 degrees with the protractor) the 45-degree body position (when the Frankfort plane of the subject was at 45 degrees and coincide with protractor following the same angle, and the supine body position (when the Frankfort plane of the subject was at 90 degrees and coincide with protractor following the same angle.)

All the registrations were assessed and noted by single observer. The frequencies of occlusal contact variations brought on by shifting body posture were calculated. Each body position's dynamic occlusion type—canine guidance (the guidance provided by canines during protrusive and lateral excursions separating the posterior teeth.), anterior guidance (the guidance provided by central and lateral incisors during protrusive and lateral movement of the mandible separating the rest of the teeth), or group function (guidance provided by multiple teeth during protrusive and lateral excursions) was noted. All the above information was recorded in a proforma.

Using SPSS 20, statistical analysis was done. Percentages and Frequencies were computed for categorical variables like gender, working side, occlusal contacts and body position. Mean±SDs were calculated for continuous factors like age of the participants. Comparison of occlusal contacts and body position were done using chi square test / fisher exact test. Stratification with respect to age, working side and gender was done to see the effect of these on result. Post stratification chi square test or fisher exact test was utilized and *p*-value ≤0.05 was considered as significant.

Results

The study involved 103 Undergraduate students at the Prosthodontics Department, Sardar Begum Dental College, Peshawar. Results of the study are as follows: -

Mean and SDs for age was 29.33±5.238. 87 (84.46%) participants were in 20-25 years' age group while 16 (15.53%) participants were in 26-30 years' age group. There were 65 (63.1%) male participants and 38 (36.9%) female participants. As per pattern of occlusal contacts, 56 (54.36%) participants had canine guidance, 3 (2.91%) participants had anterior guidance while 44 (42.71%) participants had group function (Table-1).

Table 1: Characteristics of patients.

Age Groups		*F*	*%*
Age Groups (Years)	20-25	87	84.46
	26-30	16	15.53
Gender	Male	65	63.10
	Female	38	36.89
Pattern of Occlusal Contacts	Canine Guidance	56	54.36
	Anterior Guidance	3	2.91
	Group Function	44	42.71

Table 2: Stratification of body position with pattern of occlusal contacts. (n=103)

Body Position	*Canine Guidance*	*Anterior Guidance*	*Group Function*	*Total*	*p value*
Upright	30 63.82%	11 57.89%	27 72.97%	68 66.01%	0.266
45 degrees	10 21.27%	6 31.57%	3 8.10%	19 18.44%	
Supine	7 14.89%	2 10.52%	7 18.91%	16 15.53%	
Total	47 100.0%	19 100.0%	37 100.0%	103 100.0%	

Body position was stratified and compared with pattern of occlusal contacts using chi square test in order to see effect modifiers and an insignificant difference was observed (*p* =0.266) as presented in Table-2.

Switching the body posture from vertical to supine revealed a specific alteration in the dynamic occlusion exhibited by the subject. For instance, six subjects demonstrated a change from canine guidance to group function and one changed to anterior guidance when adjusted to the 45 degrees' position, while twenty-seven subjects changed into group function from canine guidance into Supine position. A total of Twenty-two subjects had no change in dynamic tooth contacts by altering Body positions. The change in occlusal contact patterns (canine guidance, group function, and anterior guidance) on the left side and the right side when body position is altered in 103 subjects have been shown in Table-3 & 4 respectively.

On both the left and right sides, canine guidance was the most common occlusal contact pattern in the upright position (56/103 on the left, 52/103 on the right). Group function was observed in 44 participants on the left and 48 on the right, while anterior guidance was rare (3/103 on both sides).

When the body position was changed to 45 degrees, a subset of participants demonstrated transitions between contact patterns. On the left side, 6 participants with canine guidance shifted to group function and 8 with group function shifted to canine guidance. On the right side, 4 participants with canine guidance shifted to group function, while 3 with group function shifted to canine guidance. Anterior guidance remained infrequent in both positions. At 180 degrees (supine position), further variations were noted. On the left side, 27 participants with canine guidance shifted to group function and 8 with group function shifted to canine guidance. On the right side, 22 participants with canine guidance changed to group function and 8 with group function changed to canine guidance. Transitions involving anterior guidance were minimal.

Although these positional changes demonstrated variability in dynamic occlusal contacts, the overall differences were not statistically significant (*p* =0.15 for the left side, *p* =0.16 for the right side). Thus, canine guidance was the most frequent occlusal contact pattern, followed by group function, while anterior guidance was rare. Alterations in body position influenced these patterns, with the supine position showing the greatest variability, though without statistical significance.

Table 3. Distribution of occlusal contact patterns on the left side across different body positions. (n = 103)

Upright (Frequency)	*When Altered to 45 Degrees, Pattern of Occlusal Contact Changed to: (Frequency)*	*When Altered to 180 Degrees,Pattern of Occlusal Contact Changed to: (Frequency)*	*p value*
Canine guidance=56	Group function= 6 Anterior guidance=1	Group function= 27 Anterior Guidance=0	0.15
Group function=44	Canine guidance= 8 Anterior guidance= 3	Canine Guidance=8 Anterior Guidance=1	
Anterior guidance=3	Canine guidance= 0 Group function= 2	Canine guidance= 1 Group Function= 2	
103	20	39	

Table 4. Distribution of occlusal contact patterns on the right side across different body positions. (n = 103)

Upright (Frequency)	*When Altered to 45 Degrees, Pattern of Occlusal Contact Changed to:(Frequency)*	*When Altered to 180 Degrees, Pattern of Occlusal Contact Changed to:(Frequency)*	*p value*
Canine guidance=52	Group function= 4 Anterior guidance=1	Group function= 22 Anterior Guidance=0	0.16
Group function=48	Canine guidance= 3 Anterior guidance= 1	Canine Guidance=8 Anterior Guidance=0	
Anterior guidance=3	Canine guidance= 0 Group function= 6	Canine guidance= 1 Group Function= 6	
103	15	37	

Discussion

Different patterns of occlusal contacts found are Canine guided occlusion, Group function and anterior guidance through incisors. In this study 56 (54.36%) participants had canine guidance, 3 (2.91%) participants had anterior guidance through incisors while 44 (42.71%) participants had group function. These findings were consistent with the findings of study of Spikers et al, according to which significant portion of participants utilized canine assistance (44%) or group function (40%) in the upright position.[11] However, Statistics of other studies show that group function is more prevalent form of occlusal schemes.[10] In our study, the most prevalent form was canine guided occlusion. This may be because 84.46% of the participants of this study belonged to age group of 20-25 years in which there is minimal physiological tooth wear of the dentition.

Canine has a longest (single) root than any other tooth in the arch, it is located in corner of the arch, has a good crown to root ratio, its palatal surface being concave is best suitable for guiding lateral movement, these all factors make it suitable for guiding posterior teeth during lateral excursions.[12]

In the present study mean and SDs for age was 29.33$\pm$5.238, 87 (84.46%) participants were recorded in 20-25 years' age group while 16 (15.53%) participants were recorded in 26-30 years age group. This age range was chosen because there would have been fewer age changes and all of the permanent teeth would have erupted. Physiological tooth wear is an age-related phenomenon and there is usually less tooth surface loss in this age group, so natural occlusal contacts can be more precisely determined as compared to old aged individuals.[13]

From a restorative aspect, canine guidance has frequently been recommended due to its presumed protective character, which is consistent with the belief that tooth wear will be negligible in individuals with this kind of dynamic occlusion.[8] However, there isn't any scientific data favoring one contact pattern over another between canine guided occlusion and group function, however in a study conducted in implant fixed prosthetics, it was concluded that canine guided occlusion distribute forces more evenly.[14]

According to a comparison study, shimstock is more reliable in the clinical measurement of occlusal contacts than articulating film when it comes to assessing occlusal contacts.[15] This study standardized the factors which influence the outcomes of occlusal contact, such as head position and diurnal influences, in order to determine the reliability of contact recording.[16] All of the measurements were made between the hours of 9 and 11 in the morning in order to eliminate the diurnal variation inaccuracy. The relative reliability of Shim Stock occlusal registration strips in capturing occlusal contacts was assessed. The thickness of occlusal registration strips should be between 13 to 21µm thick to identify working and balancing interferences.[17]

This research revealed, the intra-observer agreement was good, indicating that the use of shim stock foil is deemed appropriate. The results of this study suggest that there are differences in the frequency of occlusal contact patterns during lateral excursions brought on by changing body posture. In a systematic review, 66.7% of articles showed relationship between pattern of occlusal contacts and body position, and 33.3% found no relationship.[18] In a study by Prasanthi G et al, the occlusal contacts in different postural positions were studied using Tekscan, they concluded that when shifting the head position from the Semi-Supine position to the other functional position, changes in occlusal contacts occur and recalibration of occlusal contacts must be taken into account in all functional postures.[19]

Although there were few participants in our study with unaltered occlusal contacts, and occlusal contacts of most of the patients changed by changing body position but the results were statistically not significant. Consequently, it is unclear if supine or upright positioning is preferable for rehabilitating occlusion. This study does, however, show that it is essential to evaluate both static and dynamic occlusion in many body positions. The degree to which change in occlusal contact pattern by changing body position could lead to altered therapeutic occlusal correction methods is uncertain.

Conclusion

It has been concluded that most of the contact pattern were canine guidance, followed by group function and anterior guidance through incisors during lateral excursions. The number of dynamic occlusal contacts in most subjects were altered with change of the body position.

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Availability of Data: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethical Approval: The Ethical Committee of Gandhara University, Peshawar approved the study.

Conflict of Interest: None declared.

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