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Prevalence of dynamic occlusion patterns seen in different age groups: A hospital-based study

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Abstract

Objective: To observe and quantify various dynamic/functional occlusal contact patterns like canine protected occlusion, group function or other occlusal patterns in laterotrusive movement of mandible in two different age groups.

Material and Methods: Dynamic occlusal contact patterns were examined during lateral excursions from the maximal intercuspal position to the canine-to-canine position in two different age groups. Total 164 subjects were selected for group A (20-30 years) and 157 subjects were selected for group B (40-50 years). Evaluation using two common clinical methods was done: visual examination and shim stock.

Result: Through visual examination on left side, canine protected occlusion was 76.2% in group A and 29.9% in group B, group function was 17.7% in group A and 61.8% in group B and the unclassified pattern (others) was 6.1% in group A and 8.3% in group B. Whereas on the right side, canine protected occlusion was 72% in group A and

24.8% in group B, group function was 21.3% in group A and 64.3% in group B and the unclassified pattern (others) was 6.7% in group A and 10.8% in group B. Using shim stock on left side, canine protected occlusion was 75 % in group A and 26.8% in group B, group function was 14.6% in group A and 55.4% in group B and the unclassified pattern(others) was 10.4% in group A and 17.8% in group B. Whereas on the right side, canine protected occlusion was 71.3% in group A and 23.6% in group B, group function was 17.1% in group A and 56.1% in group B and the unclassified pattern(others) was 11.6% in group A and 20.4% in group B.

Conclusion: The prevalence of canine protected occlusion found in this study was high in 20-30year age group and group function was high in 40-50year of age group.

Keywords: Dynamic occlusion, Functional occlusion, Occlusal patterns, Canine protected occlusion, Group function.

Introduction

Based on the work of Angle[1] and Andrews,[2] ideal static occlusion criteria have been generally accepted based on tooth position and tooth contacts in the intercuspal position.[3] In contrary, the ideal dynamic occlusion parameters are an ongoing subject to debate.[3,4] In health, the teeth function in harmony with structures controlling the movement pattern of the mandible. Structures that determine these patterns are joints, muscles and teeth.[5] 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 or appropriate functional/dynamic occlusion.[5] Dynamic occlusion is the function of the stomatognathic system as a whole comprising teeth, supporting structure, temporomandibular joint, neuromuscular and nutritive systems.[5] It is defined as the tooth contacts occurring during movement of the mandible[6], when the jaw moves laterally, in protrusion, in retrusion, or at an angle. These are not point contacts, but are lines because the cusps of teeth in mandibular arch glide over the teeth of maxillary arch during movements.

Various classifications of dynamic occlusion have been used in epidemiologic studies on occlusal contact patterns during laterotrusion. Certain authors have classified dynamic occlusion during laterotrusion on the basis of a working side occlusal contact pattern only. [8-11] This type of classification system usually divides occlusal contact patterns during laterotrusion into 3 categories: canine protected articulation[5] (CPA), group function[1] (GF), and others.

In Glossary of Prosthodontic Terms-9 canine protection is defined as “a form of mutually protected articulation in which the vertical and horizontal overlap of the canine teeth disclude the posterior teeth in excursive movement of the mandible.” Group function is defined as “multiple contact relation between maxillary and mandibular teeth in lateral movement on the working side whereby simultaneous contact of several teeth acts as a group to distribute occlusal forces.”[12]

It has been speculated that canine-guided occlusion protects the posterior teeth laterally because of the canines’ strategic location, anatomy and proprioceptive properties.[13] On the other hand, group function occlusion might contribute to a wide distribution of occlusal forces on several teeth instead of a single tooth.[14] Studies shows that with the increase in age, the dynamic occlusion pattern is shifted more to group function; due to increase in tooth wear.[15]

Thus, the purpose of this study was to observe and quantify various functional occlusal contact patterns like canine protected, group function or other occlusion pattern in laterotrusive movement of mandible in two different age groups.

Materials and Methods

This study was conducted in Department of Prosthodontics, Manubhai Patel Dental College after obtaining clearance from Institutional Research and Ethical committee (MPDC_151/PROSTHO-21/18) for a study period of 6 months. Patients visiting the Outdoor Patient department and the students of Manubhai Patel dental college were examined. In this present study, total 164 subjects were selected for group A (20 to 30 years of age) and 157 subjects were selected for group B (40 to 50 years of age). Male into female ratio was 95:69 for group A and 93:64 for group B. Average age for group A and group B were 25 year and 44 year respectively. Subjects with the following criteria were included and excluded respectively.

Inclusion Criteria	Exclusion Criteria
• Fully permanent dentition except for the third molars (if present should not interfere in occlusion) • Upper and lower canines in the line of the arch	• Previous occlusal adjustments • Large restorations involving the incisal edge or a cusp tip • Crowns or bridges in anterior region • Apparent pathologic periodontal problems • Tooth showing severe attrition or facets into the dentine

Two common clinical methods were used to examine the dynamic occlusion of the subjects i.e. (i) through visual examination and (ii) using shim stock. The subjects were made to seat in an upright position on a dental chair with the Frankfort horizontal plane parallel to the floor then the examinations were conducted. All recordings of both the assessments were made by the same operator.

a. Through visual examination:

This method was carried out visually, with the side mirror used to take intraoral photographs. The mirror was placed in the buccal vestibule and the subject was asked to close his/her mandible into maximum intercuspation (MIP). Then, instructed to move their mandibular teeth to the right side such that they would remain in contact with the maxillary teeth. These movements were performed from this maximum intercuspal position till the canine-to-canine position. The recordings were made then. The same procedure was made for the left side.

b. Using shim stock:

This method was carried out using shimstock film (Bausch Arti Fol Metallic Shimstock Film 12µ Microns) The subject was asked to open the mouth, then the shimstock film was placed on the occlusal surfaces of the mandibular teeth. They were instructed to occlude the teeth in MIP and then glide the mandibular teeth to right side up to canine-to-canine position, while the examiner maintained a constant pulling force on the shimstock. Then the recordings were made according to the movement to the shimstock over the occlusal surfaces at canine-to-canine position. The same was repeated for the left side.

c. Assessment of contacts

The assessment of contacts was made after the movement from MIP to canine-to-canine position. In this lateral excursion, the guidance pattern was considered as one of the following:

- Canine protected occlusion pattern (CP)- if only the canine tips of both the arch are contacting.
- Group function occlusion pattern (GF)- if cusp tips of canines, premolars and first molar are contacting.
- Unclassified(other) pattern- if contacts differ from the above two pattern.

d. Statistical analysis

Data were evaluated using Descriptive analysis. Chi Square test was done for comparison of the two groups and Kappa statistical analysis was carried out for comparison between the two methods.

Results

The data for intergroup comparison of different occlusal contact pattern on both the right and left side using two different methods are given in the following graphs (1-4), while the tables (1-4) show the comparison values with count percentage.

Table 1 and graph 1 shows the intergroup comparison through visual examination on left side, while table 3 and graph 3 shows for the right side. Table 2 and graph 2 shows the intergroup comparison using shim stock on left side, while table 4 and graph 4 shows for the right side. The probability level value (p value) was less than 0.05, thus there was statistically significant difference of occlusal patterns between the two age groups on both the sides.

Kappa statistical analysis was carried out for comparison between the two methods i.e. the visual examination and shim stock. Both the left and right visual and shim comparisons show kappa value of >0.8 indicating excellent agreement between the visual and the shim groups. The comparison between the two methods for left side is given in table 5, while table 6 shows the values for the right side.

Table 1: Intergroup analysis through visual examination (left side)

			Group		Total
			20-30 years	40-50 years	
Visual –left	CP	Count	125	47	172
		% within Group	76.2%	29.9%	53.6%
	GF	Count	29	97	126
		% within Group	17.7%	61.8%	39.3%
	others	Count	10	13	23
		% within Group	6.1%	8.3%	7.2%
Total		Count	164	157	321
		% within Group	100.0%	100.0%	100.0%

Chi-Square Tests			
	Value	df	P value (<0.05 is significant)
Pearson Chi-Square	72.344	2	<0.001

Table 2: Intergroup analysis using shim stock (left side)

			Group		**Total**
			20-30 years	40-50 years	
Shim –left	CP	Count	123	42	165
		% within Group	75.0%	26.8%	51.4%
	GF	Count	24	87	111
		% within Group	14.6%	55.4%	34.6%
	others	Count	17	28	45
		% within Group	10.4%	17.8%	14.0%
Total		Count	164	157	321
		% within Group	100.0%	100.0%	100.0%

Chi-Square Tests			
	Value	df	P value (<0.05 is significant)
Pearson Chi-Square	78.094	2	**<0.001**

Table 3: Intergroup analysis through visual examination (right side)

			Group		Total
			20-30 years	40-50 years	
Visual – Right	CP	Count	118	39	157
		% within Group	72.0%	24.8%	48.9%
	GF	Count	35	101	136
		% within Group	21.3%	64.3%	42.4%
	others	Count	11	17	28
		% within Group	6.7%	10.8%	8.7%
Total		Count	164	157	321
		% within Group	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	P value(<0.05 is significant)
Pearson Chi-Square	72.949	2	<0.001

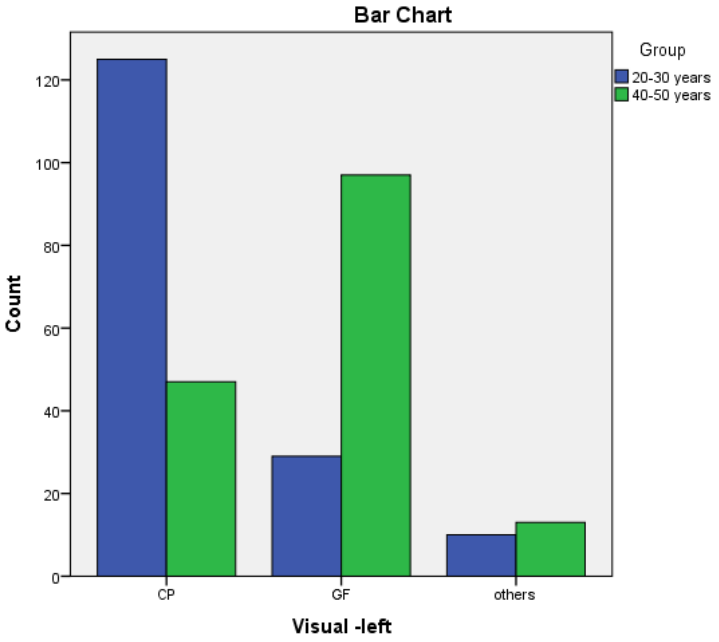
Table 4: Intergroup analysis using shim stock (right side)

			Group		Total
			20-30 years	40-50 years	
Shim –Right	CP	Count	117	37	154
		% within Group	71.3%	23.6%	48.0%
	GF	Count	28	88	116
		% within Group	17.1%	56.1%	36.1%
	others	Count	19	32	51
		% within Group	11.6%	20.4%	15.9%
Total		Count	164	157	321
		% within Group	100.0%	100.0%	100.0%

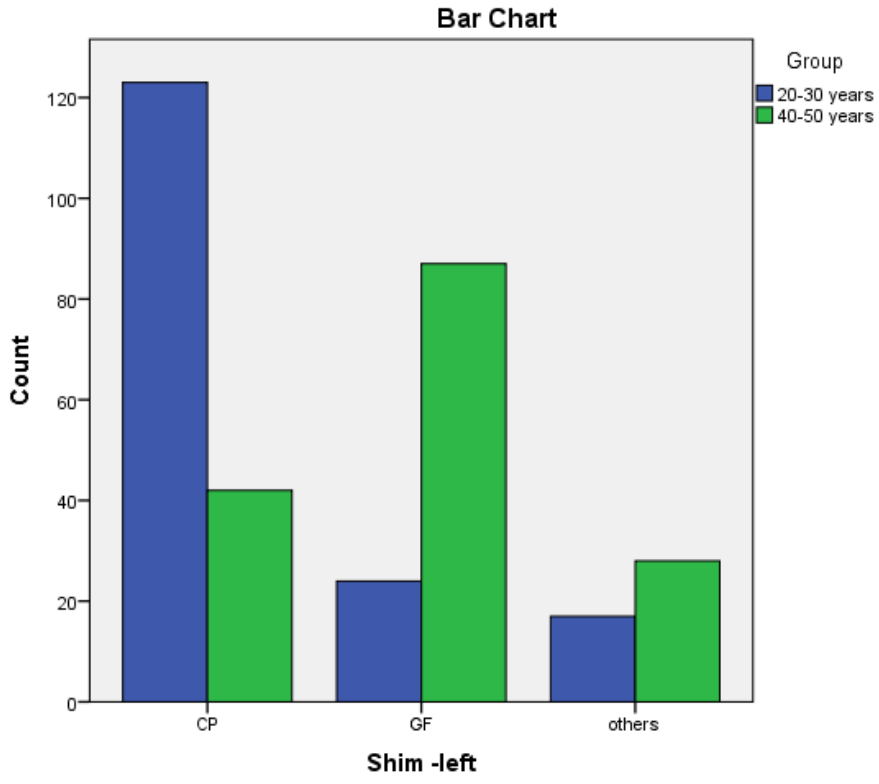
Chi-Square Tests

	Value	df	P value(<0.05 is significant)
Pearson Chi-Square	75.790	2	<0.001

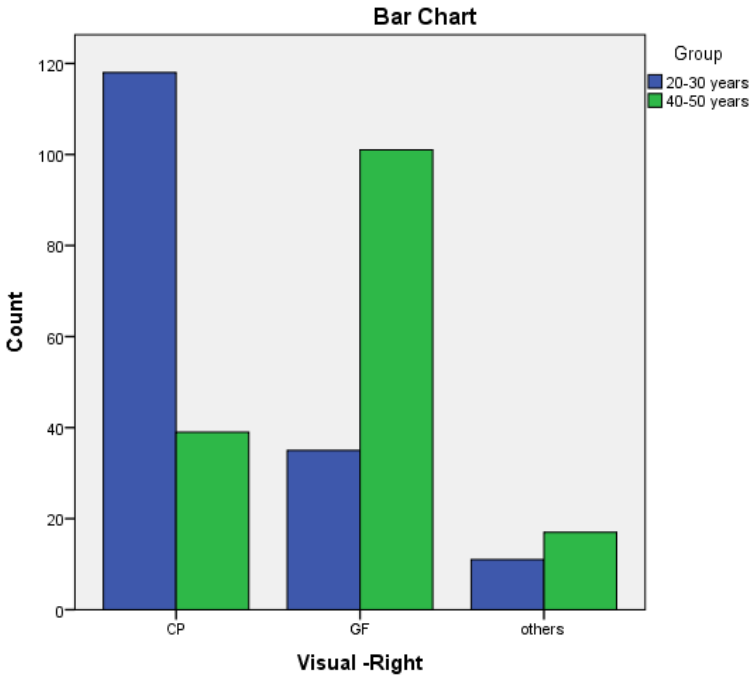
Graph 1: Intergroup analysis through visual examination (left side)



Graph 2: Intergroup analysis using shim stock (left side)



Graph 3: Intergroup analysis through visual examination (right side)



Graph 4: Intergroup analysis using shim stock (right side)

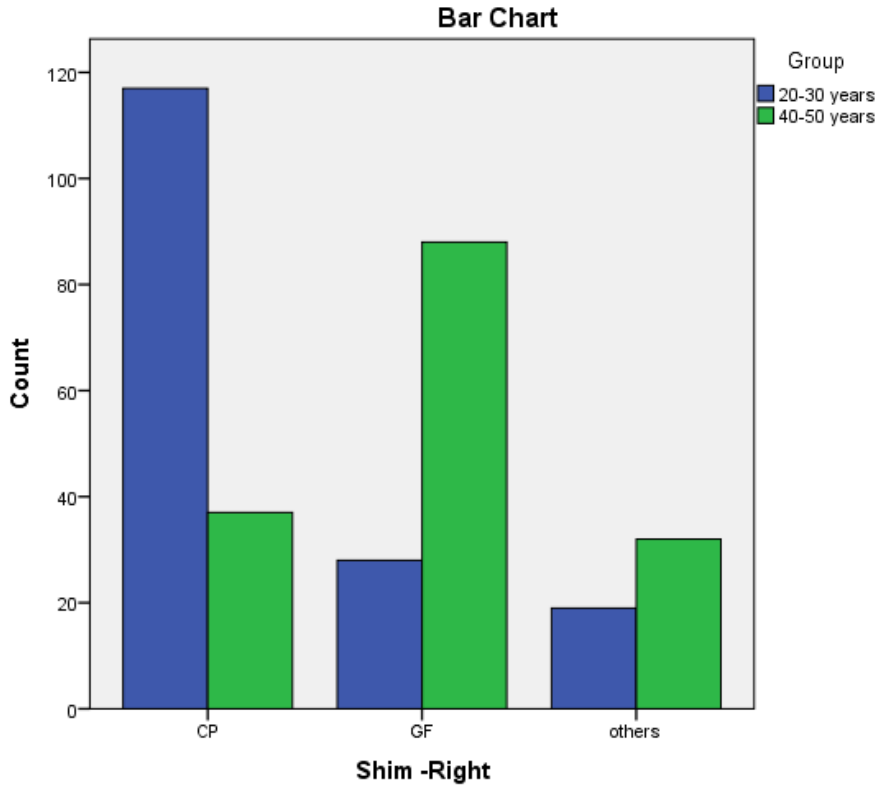


Table 5: Comparison between the two examination method (left side)

			Shim –left			Total
			CP	GF	others	
Visual –left	CP	Count	165	1	6	172
		% within Shim -left	100.0%	0.9%	13.3%	53.6%
	GF	Count	0	110	16	126
		% within Shim -left	0.0%	99.1%	35.6%	39.3%
	others	Count	0	0	23	23
		% within Shim -left	0.0%	0.0%	51.1%	7.2%
Total		Count	165	111	45	321
		% within Shim -left	100.0%	100.0%	100.0%	100.0%

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Measure of Agreement	Kappa	.876	.024	19.965	<0.001
N of Valid Cases		321			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Table 6: Comparison between the two examination method (right side)

Crosstab

			Shim –Right			Total
			CP	GF	others	
Visual –Right	CP	Count	154	0	3	157
		% within Shim -Right	100.0%	0.0%	5.9%	48.9%
	GF	Count	0	116	20	136
		% within Shim -Right	0.0%	100.0%	39.2%	42.4%
	others	Count	0	0	28	28
		% within Shim -Right	0.0%	0.0%	54.9%	8.7%
Total		Count	154	116	51	321
		% within Shim -Right	100.0%	100.0%	100.0%	100.0%

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	P VALUE
Measure of Agreement	Kappa	.880	.023	20.499	<0.001
N of Valid Cases		321			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Discussion

The purpose of this study was to observe and quantify various functional occlusal contact patterns like canine protected, group function or other occlusal pattern in laterotrusive movement of mandible in two different age groups.

The most important requirements to identify the occlusal contacts using the occlusal registration strip is its thickness, strength and the plastic deformation. A thin occlusal strip is necessary to identify occlusal contact because it has occlusal thickness below the perception level of patients. Whereas a thick occlusal registration strip has two major disadvantages: (1) if the thickness of the registration strips is greater, then it can indicate tooth contact even though there is no tooth contact and (2) it can institute a proprioceptive response which can cause the jaw to be deflected. So, a thin 12µm film was selected for this study. Also, the shim stock has greater reliability than the articulating film (p value - <0.01). Some studies used different methods, such as dental floss and articulating paper[16], articulating wax and dental floss[17], silicone registration material[18], alginate indices[19], T-scan[20], or articulating paper on articulated diagnostic casts[21]. Gazit et al[22] documented problem with reliability while using articulating film. Other than the reliability, the shim stock occlusal strip has better plastic deformation, tensile strength and water-resistant nature. So, shim stock was chosen for this study.

Occlusal contacts were recorded during movement from the maximal intercuspal position to the canine-to-canine position in this study. Some studies recorded contacts at certain defined positions. Sapkota et al[23] recorded the occlusal contacts in approximately 0.5-1mm lateral positions. In many studies of occlusal contact patterns, the occlusal contacts were recorded in an edge-to-edge position of the canines approximately 3 mm lateral from the maximum intercuspation, or in an unregulated position.

Finding of this study was the prevalence of canine protected occlusion through visual examination on left and right side was 76.2% in group A and 29.9% in group B and 72% in group A and 24.8% in group B respectively. Whereas the prevalence of group function through visual examination on left and right side 17.7% in group A and 61.8% in group B and 21.3% in group A and 64.3% in group B respectively. The prevalence of unclassified patterns was in 6.1% in group A and 8.3% in group B through visual examination on left side and 6.7% in group A and 10.8% in group B on right side.

Using shim stock, the prevalence of canine protected occlusion on the left and right side was 75% in group A and 26.8% ingroup B and 71.3% in-group A and 23.6% in group B respectively. Whereas group function was 14.6% in group A and 55.4% in-group B and 17.1% in group A and 56.1% in group B respectively. And unclassified pattern was 10.4% in group A and 17.8% in group B and 11.6% in group A and 20.4% in group B respectively.

Scaife and Holt[24] found the prevalence of canine protected occlusion in 73.4% subjects and group function in 26.6% subjects in the age group between 17 to 25 years. Guevara and Ismail[25] found the prevalence of canine protected occlusion in 58.4% subjects and group function in 27.3% subjects in the age group between 23 to 37 years. Sapkota et al[23] found the prevalence of canine protected occlusion in 12% and 2.5% while using shim stock and articulating paper respectively, whereas group function was found in 84% and 94% while using shim stock and articulating paper respectively whereas unclassified pattern was found in 4% and 3.5% while using shim stock and articulating paper respectively in the age group of 18-30 years.

The results of this study demonstrated greater prevalence of canine protected occlusion in 20 to 30 years of age and group function in 40 to 50 years of age. We also found no difference of assessment between both the clinical methods.

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