International Journal of Enhanced Research in Medicines & Dental Care (IJERMDC),
ISSN: 2349-1590, Vol. 9 Issue 3, March 2022, Impact Factor: 7.125

Dentoalveolar Compensatory Changes in Different Overjet Patterns in District Solan Population- A Cephalometric Study

Dr. Sanjay Mittal[1], Dr. Kusha Sud[2], Dr. Isha Aggarwal[3], Dr. Tanzinpalkit[4], Dr. Merry[5], Dr. Avijit Awasthi[6]

[1]MDS (Orthodontics), HOD and Professor, Department of Orthodontics and Dentofacial Orthopedics, Bhojia Dental College and Hospital, Himachal Pradesh, India
[2]MDS (Orthodontics), Post Graduate Student, Department of Orthodontics and Dentofacial Orthopedics, Bhojia Dental College and Hospital, Himachal Pradesh, India
[3]MDS (Orthodontics), Reader, Department of Orthodontics and Dentofacial Orthopedics, Bhojia Dental College and Hospital, Himachal Pradesh, India
[4,5]MDS (Orthodontics), Senior lecturer, Department of Orthodontics and Dentofacial Orthopedics, Bhojia Dental College and Hospital, Himachal Pradesh, India
[6]MDS (Public Health), Reader, Department of Public Heatlh, Department of Orthodontics and Dentofacial Orthopedics Bhojia Dental College and Hospital, Himachal Pradesh, India

Corresponding Author: Dr. Kusha Sud, MDS (Orthodontics), Post Graduate Student, Department of Orthodontics and Dentofacial Orthopedics, Bhojia Dental College and Hospital, Himachal Pradesh, India, Email: kushasud@gmail.com

ABSTRACT

Intro: The variation in jaw relationship has been compensated for by the dentoalveolar compensatory mechanism. Therefore, a better understanding of the differences in dentoalveolar compensation in different overjet subjects may be useful in the analysis and treatment planning of different cases.

Aim: Correlation of overjet patterns with their dentoalveolar compensation in district Solan population.

Materials and method: 80 lateral cephalometric records of untreated subjects were selected. They were divided into 3 groups as Group 1(N=30,Normal), Group 2(N=30,Edge to Edge) and Group 3(N=30, Positive) on the basis of their overjet patterns.7 linear and 8 angular measurements were recorded for these 3 groups.values obtained were subjected to statistical analysis.

Result: The results showed that LI-SN(p=0.000*), SN-AB(P=0.02*) were increased in edge to edge group and were statistically significant. Whereas there was a statistically non-significant difference in UI-LI (p=0.09) when compared between groups. In positive group statistically significant differences were found in UI-NA (p=0.001*) and UI-NB (P=0.00*).In normal group there was a statistically significant difference in LI-MP (P=0.00*), SN-OP (0.00*) and UI-SN (p=0.03*). Linear measurements showed that in positive group UI-NA (P= 0.00*), LI–NB (P=0.00*), MdAABH (P= 0.00*) were increased and statistically significant, whereas MxPABH (P=0.42), MdPABH (p= 0.21) were increased and showed non-significant results. In edge to edge group MxAABH (p= 0.03) was statistically significant and MxAD (P=0.59) was non significant.

Keywords: Overjet, dentoalveolar compensation, Cephalometry

INTRODUCTION

An important component of many orthodontic assessments is evaluation of the horizontal relationship of the teeth and jaws.[1] Co-ordination of the development of the upper and lower arches is not always ideal. However for the achievement and maintenance of good normal relationship between upper and lower dental arches, certain mechanisms therefore, are needed to co-ordinate the eruption and position of the teeth relative to their basal bone. This is what is called "dentoalveolar compensation" and can be defined as a system which attempts to maintain normal inter arch relationships. Despite some variation in facial pattern during facial growth and development, normal occlusion can be attained and maintained primarily through dental compensation.

The role of dentoalveolar compensation in the development of normal occlusion has been reported by a number of studies. The compensatory inclination of the maxillary and mandibular incisors results in normal incisor relationships despite some variations in sagittal jaw relationships. The cant of the occlusal plane adjusts sagittal relationships between the maxillary and mandibular dental arches. Some authors have suggested that malocclusion results from insufficient dentoalveolar compensation for variations in facial patterns. During facial growth and development, normal occlusion can be attained and maintained despite some variations in facial pattern, primarily as a result of dental compensation.

Solow (1980) stated that co-ordination of the development of the upper and lower arches is not always perfect. Quantitative evaluation of both the vertical and saggittal dentoalveolar adaptation in different overjet pattern may provide not only additional information for prediction of growth changes but also useful for planning treatment of subjects with different inter-arch relationships.[1]

There is a difference in the interarch relationships of subjects with Class I, II, III malocclusions due to differences in the skeletal morphology.

Zupancic etal.(2008) found that overjet cannot describe the skeletal state in Class I and III malocclusion, but it can be a good predictor of skeletal conditions in Class II division 1 malocclusion.[2] Furthermore, a study by ***Ardani et al.(2000)*** in Javanese population showed that Class II skeletal malocclusion with anteroposterior skeletal discrepancies are characterized by a large ANB reflecting the mal-relationship between the maxilla and mandible. Class II skeletal malocclusion has an increased ANB, mostly not by the rising Sella–Nasion–A point (SNA) but by the declining Sella–Nasion–B point (SNB).[3]

Kuitert et al concluded that dentoalveolar compensatory mechanism acted mainly by vertical adaptation of the mandibular frontal alveolar process.[4] Additional compensation could be gained in short face subjects by maxillary incisor protrusion, but in long face subjects, a corresponding maxillary incisor retrusion didn't occur which was considered unphysiologic. In the long face group, mandibular incisor retrusion had a minor compensatory role that they considered clinically irrelevant.
So, the purpose of this study was to investigate the dentoalveolar compensation in subjects with different overjet patterns and to determine the cephalometric parameters that quantitatively describe dental compensations in district Solan population.

AIM AND OBJECTIVES

Correlation of overjet patterns with their dentoalveolar compensation in district Solan population.

MATERIALS AND METHOD

80 pretreatment lateral cephalometric records of subjects who reported to the Department of orthodontics and Dentofacial Orthopaedics of Bhojia Dental College for fixed mechanotherapy were selected. They were divided into 3 groups with 30 subjects in each group on the basis of their overjet pattern (Table 1).

Table 1: Grouping of Sample

GROUP I (N=30)	GROUP II (N=30)	GROUP III (N=30)
Normal overjet more than +1 mm but less than or equal to +2 mm	**Edge-to-edge** overjet more than –1 mm but less than +1 mm	**Positive (increased)** overjet more than +2 mm.

Inclusion Criteria

- The subjects with all permanent teeth

Exclusion Criteria

- Severe craniofacial disorders such as a cleft palate
- Subject who had undergone orthodontic therapy

All the cephalograms were traced by the same operator manually. All the landmarks (Table 2, Fig 1) were identified and marked. Seven linear (Table 3, Fig 2) and eight angular (Table 4, Fig 3) measurements were recorded to assess dentoalveolar compensation.

Table 2: Landmarks Used In The Study

LANDMARK	DEFINITION
Na (Nasion)	Most anterior point on the frontonasal suture in the median planemaxilla.
Point A (Subspinale)	Point at the deepest midline concavity between anterior nasal spine and prosthion.
Point B	Point of deepest midline concavity on the mandibular symphysis.
Me	Most inferior midline point on the mandibular symphysis.
Pog	Most anterior point of the bony chin in the median plane.
PTM	Bilateral tear drop shaped area of radiolucency ,the landmark is taken where the two edges, front and back appear to merge inferiorly.
S	Point representing the midpoint of the pituitary fossa.

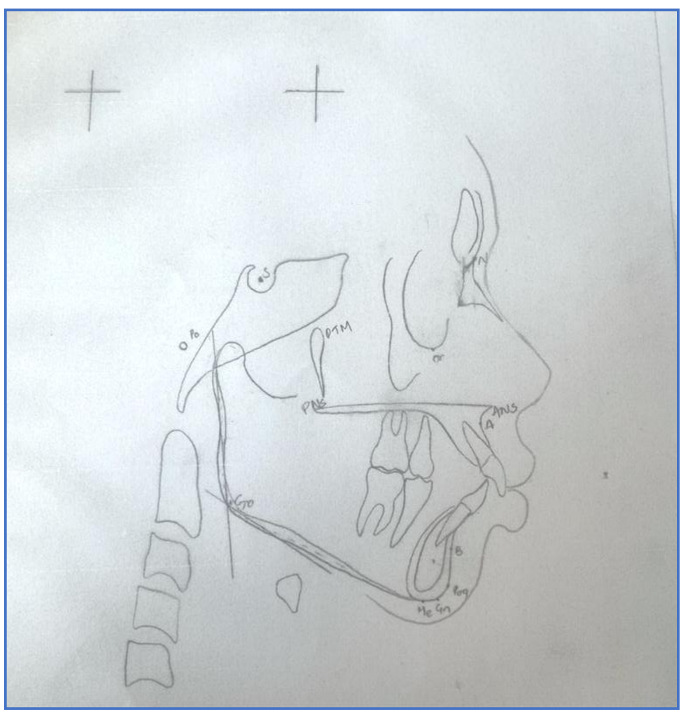

Figure 1: landmarks used in the study

Table 3: Linear Measurements Used In The Study

PARAMETER	DEFINITION
MxAABH (maxillary anterior alveolar and basal height)	the distance between the midpoint of thealveolar meatus of the maxillary central incisor and the intersection point between the palatal line andthe long axis of the maxillary central incisor.

MxAD (maxillary anterior depth)	the distance between points A and A′ (A′: from point A, a linewas drawn parallel to the palatal line intersecting the dorsal contour of the maxillary alveolar bone).
MxPABH (maxillary posterior alveolar and basal height)	the perpendicular distance between themidpoint of the alveolar meatus of the maxillary first molar and the palatal line.
MdAABH (mandibular anterior alveolar and basal height)	the perpendicular distance between themidpoint of the alveolar meatus of the mandibular central incisor and the mandibular line.
MdPABH (mandibular posterior alveolar and basal height)	the perpendicular distance between the midpoint of the alveolar meatus of the mandibular first molar and the mandibular line.
1—NA	the horizontal distance between the buccalsurface of the maxillary central incisor and N–A line.
1–NB	the horizontal distance between the buccalsurface of the mandibular central incisor and N–B. line.

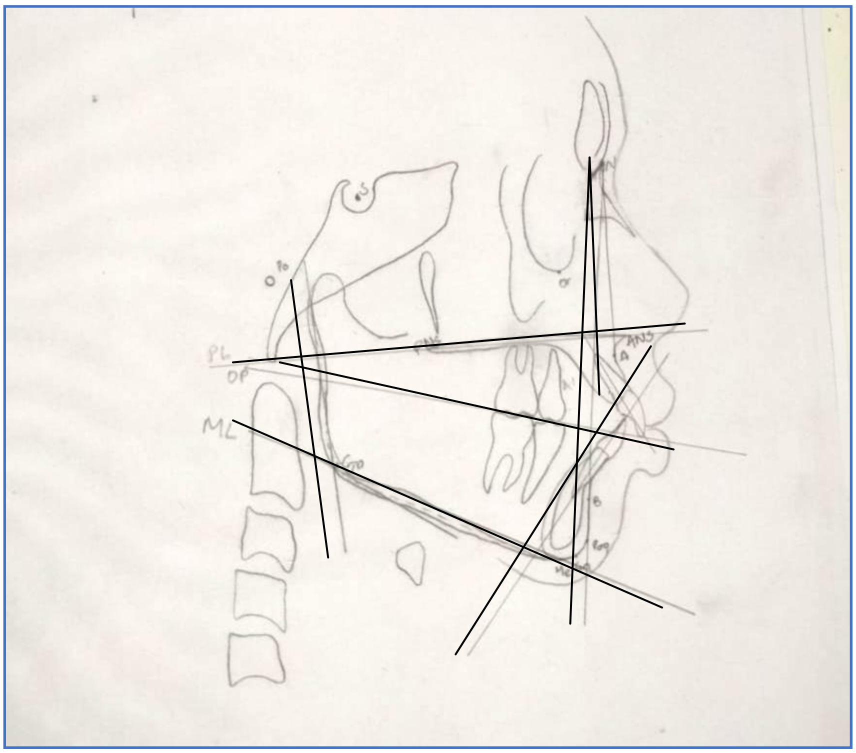

Figure 2: linear measutrements used in the study

Table 4: Angular Measurements Used In The Study

PARAMETERS	DEFINITION
Upper incisors and lower incisors(UI-LI)	the angle between the long axes of the maxillary and mandibular central incisors
Upper incisor to SN (UI-SN)	the angle between the long axis of the maxillary central incisor and the S–N line
Lower incisor –SN (LI-SN)	the angle between the long axis of the mandibular central incisor and the S–N line
Upper incisor –NA (UI-NA)	the angle between the long axis of the maxillary central incisor and the N–A line
Lower incisor –MP (UI-MP)	the angle between the long axis of the

	mandibular central incisor and the mandibular line (Go–Me)
SN–AB	the angle between the S–N and A–B lines
SN–OP	the angle between the S–N and occlusal lines.

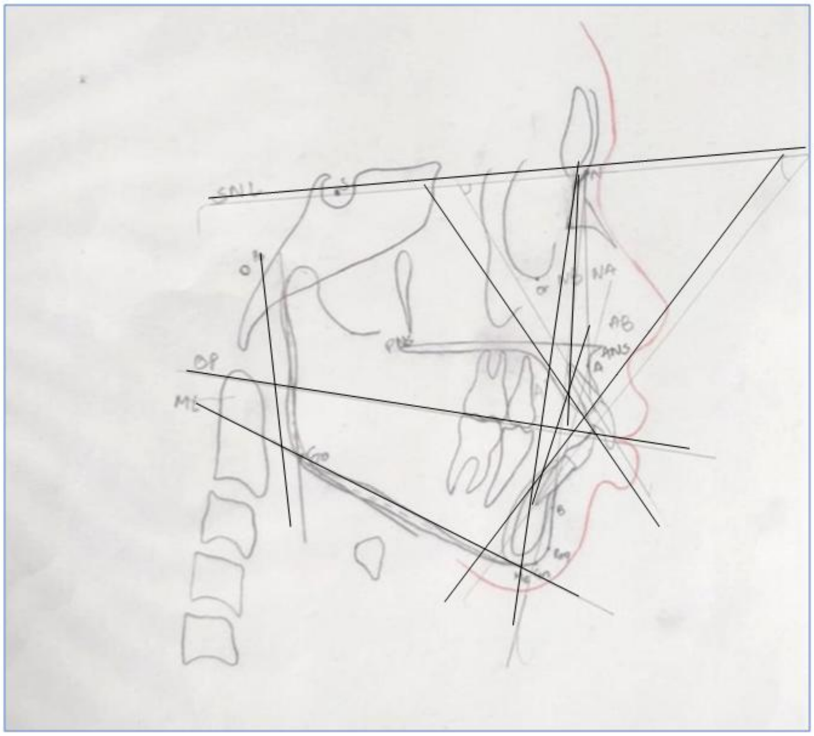

Figure 3: Angular measurements used in the study

All parameters were recorded for all the 3 groups and values so obtained were subjected to statistical analysis.

Statistical Analysis

The values so obtained were subjected to statistical analysis. SPSS software was used. Standard deviation and mean values were calculated and means of the parameters were analysed by comparing the 3 groups using one way ANNOVA. The level of significance was (p>0.05). Correlation coefficients were calculated using Pearson's correlation.

RESULT

80 pretreatment lateral cephalometric radiographs of subjects who reported to the Department of orthodontics and Dentofacial Orthopaedics of Bhojia Dental College for fixed mechanotherapy were selected. They were divided into 3 groups with 30 subjects in each group on the basis of their overjet pattern. Various angular and linear measurements were recorded for the 3 groups. Means and standard deviations were calculated for the 3 groups and comparisons were made using One Way Annova. Correlation coefficients between the parameters and overjet pattern was calculated using Pearson's correlation.

Table 5: Comparison Of Angular Parameters Between The Groups Using One Way –Annova

PARAMETERS	GROUP	(Mean ± SD)	Sum of Squares		df (Degree of freedom)	F Value	P Value
UI to LI	Edge-to-Edge	122.13 ± 23.96	**Between the Groups**	1662.422	2	2.395	**0.09**

	Normal	128.56 ± 13.93	**Within the Groups**	30188.300	87		
	Positive	118.13 ± 16.49					
UI to SN	Edge-to-Edge	113.96 ± 10.35	**Between the Groups**	576.800	2	3.402	**0.03***
	Normal	108.16 ± 7.45	**Within the Groups**	7376.100	87		
	Positive	112.96 ± 9.57					
LI to SN	Edge-to-Edge	61.76 ± 9.89	**Between the Groups**	2305.267	2	11.350	**0.000***
	Normal	60.20 ± 10.59	**Within the Groups**	8834.833	87		
	Positive	50.33 ± 9.72					
UI to NA	Edge-to-Edge	27.06 ± 8.47	**Between the Groups**	1078.689	2	7.179	**0.001***
	Normal	28.53 ± 8.41	**Within the Groups**	6536.300	87		
	Positive	35.03 ± 9.09					
LI to MP	Edge-to-Edge	94.66 ± 5.26	**Between the Groups**	1062.156	2	6.365	**0.00***
	Normal	103.06 ± 8.46	**Within the Groups**	7258.833	87		
	Positive	99.30 ± 12.28					
SN to AB	Edge-to-Edge	86.46 ± 10.13	**Between the Groups**	1264.467	2	4.100	**0.02***
	Normal	78.43 ± 7.87	**Within the Groups**	13415.133	87		
	Positive	86.30 ± 17.25					
SN to OP	Edge-to-Edge	12.86 ± 4.61	**Between the Groups**	556.822	2	11.018	**0.00***
	Normal	14.50 ± 3.58	**Within the Groups**	2198.333	87		
	Positive	18.76 ± 6.45					
UI to NB	Edge-to-Edge	31.73 ± 7.01	**Between the Groups**	640.289	2	**3.466**	**0.00***
	Normal	28.50 ± 7.93	**Within the Groups**	8036.333	87		
	14.50 ± 3.58	14.50 ± 3.58					

In angular parameters (Table 5) it was observed that UI to NA was increased in positive group (28.53 ± 8.41) than the other two groups and was statistically significant (p=0.001*) when the comparison was made. LI to SN was increased in edge to edge (61.76±9.89) than the other 2 groups and was statistically significant (p=0.000*). LI to MP was increased in Normal group (103.06 ± 8.46) than the other two groups and was statistically significant(p=0.00*).SN to AB was increased in edge to edge group (103.06± 8.46)than the other two groups and was statistically significant (p=0.02*).SN to OP in the normal group had an increased value of (14.50 ± 3.58) and was found to be statistically significant (p=0.00*).UI to NB in the positive group showed increased value (14.50 ±3.58) and was statistically highly significant (p=0.00*), UI to SN was increased in normal group(128.56 ± 13.93) which was still considered stastically significant(p=0.09) and UI to LI in the edge to edge group(113.96 ± 10.35) and was highly statistically significant (p=**0.03*)**

Table 6: Comparison Of Linear Parameters Between Groups Using Annova

PARAMETERS	Group	(Mean ± SD)	Sum of Squares		Df (Degree of freedom)	F Value	P Value
MxAABH	Edge-to-Edge	17.96 ± 3.92	**Between the Groups**	67.267	2	3.546	**0.03***
	Normal	15.90 ± 1.78	**Within the Groups**	825.133	87		
	Positive	16.53 ± 1.33					
MxAD	Edge-to-Edge	11.73 ± 2.99	**Between the Groups**	15.800	2	0.516	0.59
	Normal	10.73 ± 4.05	**Within the Groups**	1331.100	87		
	Positive	11.43 ± 4.52					
MxPABH	Edge-to-Edge	13.73 ± 2.21	**Between the Groups**	21.800	2	0.86	0.42
	Normal	14.23 ± 4.03	**Within the Groups**	1103.100	87		
	Positive	14.93 ± 4.10					
MdPABH	Edge-to-Edge	20.76 ± 3.23	**Between the Groups**	25.756	2	1.575	0.21
	Normal	20.00 ± 2.65	**Within the Groups**	711.367	87		
	Positive	22.00 ± 2.65					
UI-NA	Edge-to-Edge	6.90 ± 2.17	**Between the Groups**	230.956	2	8.654	**0.00***
	Normal	6.53 ±2.31	**Within the Groups**	1160.867	87		
	Positive	10.10 ± 4.92					
LI-NB	Edge-to-Edge	6.43 ± 1.79	**Between the Groups**	139.878	2	9.849	**0.00***
	Normal	5.33 ± 1.84	**Within the Groups**	14.202	87		
	Positive	9.50 ± 5.99					
MdAABH	Edge-to-Edge	25.43 ± 3.63	**Between the Groups**	262.867	2	6.433	**0.00***
	Normal	23.00± 5.43	**Within the Groups**	1777.533	87		
	Positive	27.16 ± 4.30					

Among the linear parameters (Table 6) it was observed that mandibular anterior alveolar (MdAABH) (27.16 ± 4.30) and basal height (MdPABH) (27.16 ± 4.30), UI to NA (10.10 ± 4.92) and LI to NB (9.50 ± 5.99) were increased in positive group than the other 2 groups and were found to be statistically significant (p=0.00*). Maxillary anterior depth (MxAD) (11.73 ± 2.99) was increased in edge to edge group and was found to be statistically non significant (p= 0.59), whereas maxillary anterior alveolar (MxAABH) (17.96 ± 3.92) and basal height (MxPABH) (17.96 ± 3.92) were increased in edge to edge group and were found to be statistically significant (p=0.003 *).Maxillary posterior alveolar basal height (MxPABH) was increased in positive group (14.93 ± 4.10) and was statistically non-significant (p=0.59).

Table 7: Correlation Coefficients Between Overjet And Parameters Using Pearson's Correlation

Parameters	Overjet (R)	P Value
Linear		
MxAABH	-1.62	0.12
MxAD	0.00	0.98
MxPABH	0.09	0.36
1-NA	0.35**	**0.001****
1-NB	0.36**	**0.00****
MdAABH	0.14	0.17
Angular		
UI – LI	-0.137	0.19
UI – SN	-0.001	0.99
LI – SN	-0.440**	**0.00**
UI – NA	0.392**	**0.00**
LI – MP	0.190	0.07
SN – AB	0.029	0.78
SN – OP	0.430**	**0.00**
UI – NB	0.162	0.12

The Correlation Coefficients between overjet and the linear and angular parameters were correlated using Pearson's correlation and depicted in (Table 7) and largest correlation were found between overjet and LI – SN (R=-0.440**). In addition significant correlations were found between overjet and UI-NB(R=0.36**), LI-NA (R=-0.35**),UI-NA (R=0.392), SN-OP (R=-0.430**).

DISCUSSION

The dentoalveolar compensation mechanism can involve height, depth, and volume of the symphysis and the anterior part of the maxilla. So further the terme 'dentoalveolar compensation' and can be defined as a system, which attempts to maintain normal interarch relationships under varying jaw relationships The purpose of the present study was to investigate and compare dentoalveolar compensation in subjects with different overjet patterns for that 80 pretreatment lateral cephalometric radiographs were selected. They were divided into 3 groups with 30 subjects in each group on the basis of their overjet pattern. 8 angular and 7 linear measurements were recorded for the 3 groups. The values obtained were subjected to statistical analysis.The results of this study indicate that there are statistically significant differences in the angular and linear measurements among the overjet groups. Among the angular parameters when comparison was made it showed that the LI-SN, SN-AB were increased in edge to edge group and were statistically significant. Whereas UI-LI was statistically non-significant when comparison was made between the groups. UI-NA and UI-NB was increased in positive group and were statistically significant. In normal group LI-MP, SN-OP and UI-SN were increased and and were highly significant. ***Nabila Anwar(2009)*** evaluated the pattern of dentoalveolar compensation in skeletal Class II patients and to find which dentoalveolar parameter compensates the most for this sagittal jaw discrepancy. They concluded Lower incisor position and occlusal plane inclination in relation to the craniofacial structures are the most likely parameters for compensation in Class II sagittal jaw discrepancy, evaluation of which may be helpful in treatment planning and treatment success.[5] These findings are in agreement with the present study. ***Bibby (1980)*** also found that the upper incisor inclination was significantly different between all 3 skeletal Classes which were not in concordance to our study.[6]

Hiroyuki Ishikawa(2000)studied compensatory changes for sagittal jaw discrepancies in the negative overjet cases were statistically confirmed for both incisor inclination and occlusal plane angulation. However, the compensatory effects were weaker than in the normal overjet cases. The discriminate analysis successfully separated the normal and negative overjet cases, suggesting that negative overjet results from insufficient dentoalveolar compensation for variations in the sagittal jaw relationships.[7]

Among the Linear parameters UI-NA, LI –NB , MdAABH were increased and statistically significant, whereas MxPABH , MdPABH were increased and showed non-significant results. In edge to edge group MxAABH was statistically significant and MxAD was non significant. Maxillary dentoalveolar heights and mandibular dentoalveolar heights were both effective in providing dentoalveolar compensation in different overjet patterns as provide an adaptation to a variable amount of overjet in different overjet patterns. ***Janson et al. (1994)*** reported that maxillary and mandibular dentoalveolar heights were similar between Class I and Class II dental and skeletal malocclusions. [8]

CONCLUSION

1) Angular measurements showed that , LI-SN(p=0.000*), SN-AB(P=0.02*) were increased in edge to edge group and were statistically significant. Whereas there was a statistically non-significant difference in UI-LI (p=0.09) when compared between groups. LI-MP (P=0.00*), SN-OP (0.00*) and UI-SN (p=0.03*) were increased in normal group and were statistically significant.

2) Linear measurements showed that in positive group UI-NA (P= 0.00*), LI–NB (P=0.00*) MdAABH (P= 0.00*) were increased and statistically significant, whereas MxPABH (P=0.42), MdPABH (p= 0.21) were increased and showed non-significant results. In edge to edge group MxAABH (p= 0.03) was statistically significant and MxAD (P=0.59) was non significant.

3) The Correlation Coefficients between overjet and the linear and angular parameters were correlated largest correlation were found between overjet and LI – SN (R=-0.440**).

REFRENCES

[1]. Solow B 1980 The dentoalveolar compensatory mechanism: background and clinical implications. British Journal of Orthodontics 7: 145–161

[2]. Zupancic S, Pohar M, Farcnik F, Ovsenik M. Overjet as a predictor of sagittal skeletal relationships. Eur J Orthod 2008;30:269-73.

[3]. Ardani IG, Willyanti I, Narmada IB. Correlation between vertical components and skeletal Class II malocclusion in ethnic Javanese. Clinical, cosmetic and investigational dentistry. 2018;10:297.

[4]. Kuitert R, Beckmann S, van Loenen M, Tuinzing B, Zentner A. Dentoalveolar compensation in subjects with vertical skeletal dysplasia. American journal of orthodontics and dentofacial orthopedics. 2006 May 1;129(5):649-57.

[5]. Anwar N, Fida M. Evaluation of dentoalveolar compensation in skeletal class II malocclusion in a Pakistani University Hospital setting. Journal of the College of Physicians and Surgeons Pakistan. 2009;19(1):11.

[6]. Bibby R E 1980 Incisor relationships in different skeletofacial patterns. Angle Orthodontist 50: 41–44

[7]. Ishikawa H, Nakamura S, Iwasaki H, Kitazawa S, Tsukada H, Chu S 2000 Dentoalveolar compensation in negative overjet cases. Angle Orthodontist 70: 145–148

[8]. Janson G R P, Metaxas A, Woodside D G 1994 Variation in maxillary and mandibular molar and incisor dimension in 12 yearold subjects with excess, normal, and short lower face height. American Journal of Orthodontics and Dentofacial Orthopedics 106: 409–418