EVALUATION OF DENTOALVEOLAR COMPENSATION IN VARIOUS SKELETAL DYSPLASIAS — A CEPHALOMETRIC STUDY

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Abstract: The aim of this study was to evaluate and compare dentoalveolar compensations in various skeletal dysplasias.

Methods: The sample consisted of 130 lateral head cephalograms of subjects age ranged between 15-24 years with a mean age of 19.5 years. The sample was divided into four groups according to anteroposterior skeletal relationships as follows—Control.

Control: Group comprising Normal occlusion and other three groups were of different malocclusions. Group-I—comprising of Skeletal Class-I malocclusion, Group-II—comprising of Skeletal Class-II malocclusion and Group-III—comprising of Skeletal Class-III malocclusion based upon the Wits appraisal, APP-BPP measurement and B-angle measurement, collectively. In this study dentoalveolar linear and angular measurements have been measured on the tracing of lateral head Cephalogram.
INTRODUCTION

Normal growth and development of face can attain and maintained normal occlusion and esthetics because oro-facial equilibrium is maintained. Normal growth and development of jaws can be affected by various hereditary and environmental factors. The development of the upper and lower arches are not always perfect. Some physiological processes is needed to co-ordinate the eruption and position of the teeth relative to their basal bones in order for a normal relationship between the upper and lower dental arches to be achieved and maintained. This mechanism is known as dentoalveolar compensation. For existing sagittal jaw discrepancies, compensatory inclination of the maxillary and mandibular incisors results in compromised dentoalveolar and incisor relationships.

A better knowledge of dentoalveolar compensation in different skeletal pattern subjects may be useful to understand the orofacial functions, diagnosis and treatment planning of individuals. The compensatory inclination of the maxillary and mandibular incisors try to attained in normal incisor relationships in some cases despite some variations in sagittal jaw relationships. The cant of the occlusal plane trying adjusts sagittal relationships between the maxillary and mandibular dental arches. Quantitative evaluation of the dentoalveolar adaptation to jaw relationship would provide additional information for treatment planning.

Keeping this in mind this study was done with the aims and objectives of:

1. To evaluate dentoalveolar compensations in various skeletal dysplasias.
2. To compare the dentoalveolar compensations in various skeletal dysplasias.

MATERIALS AND METHODS

The present study was conducted on 130 lateral head cephalograms of subjects age ranged between 15-24 years with a mean age of 19.5 years. The subjects was divided into four groups, Control Group, Group-I, Group-II and Group-III with different skeletal malocclusions. The subjects of control groups (normal occlusion ) were selected from the students of C.S.M. Medical University, Lucknow, while the cephalograms of the skeletal malocclusion Groups were obtained from the patient record files, and the patients attending the OPD of the Department of Orthodontics and Dentofacial Orthopaedics, Faculty of Dental Sciences, C.S.M. Medical University, Lucknow.

The subjects was divided according to antero-posterior skeletal relationships as follows - Control Group comprising of 35 subjects with Normal occlusion and other three groups were of different skeletal malocclusions. Group-I - comprising of 35 subjects with Skeletal Class-I malocclusion, Group-II - comprising of 35 subjects with Skeletal Class-II malocclusion and Group-III - comprising of 25 subjects with Skeletal Class-III malocclusion based upon the Wit’s appraisal, APP-BPP measurement (Ram S. Nanda and Robert M. Merrill) and β-angle measurement (Chong Yol Baik and Maria Ververidou, 2004) collectively. All these measurements were used to ensure the skeletal patterns of the subjects (Fig. 1). Cephalometric Landmarks and Reference Plane used in the study given in Fig. 2,3,4.

The subjects of control groups were selected on the bases of clinical examination and cephalometric analysis with following features like Skeletal Class-I Pattern, pleasing profile, symmetrical face, Class-I molar relationship, No rotations, No spacing, No crowding, Class-I canine relationship, normal Overjet and overbite, maximum intercuspation, No permanent
teeth missing. No history of orthodontic treatment and class-I skeletal pattern.

The subjects of malocclusion Groups were screened after clinical examination and following cephalometric parameter were used to access the skeletal pattern of Groups-I, Groups-II and Groups-III.

Group I: Skeletal Class I malocclusion subjects were having
- Wit's appraisal (between 0 - 1 mm.)
- APP - BPP (2 mm - 8 mm).
- βangle between 27° - 35°.

Group II: Skeletal Class-II malocclusion subjects were having
- Wit's appraisal more than 1.
- APP - BPP more than 8 mm.
- βangle less than 27°.

Group III: Skeletal Class III malocclusion subjects were having
- Wit's appraisal less than 0 mm.
- APP - BPP less than 2 mm.
- βangle more than 35°.

The cephalograms were obtained over a universal counter balancing type of cephalostat with the Frankfurt horizontal plane parallel to the floor and the teeth in centric occlusion with relaxed lips. Kodak X-ray films (8" x 10") were exposed at 70 KVP; 40 mA for 1.8 seconds from a fixed distance of 60 inches. The lateral head cephalograms were traced on acetate tracing sheets 0.003 inch in thickness using a sharp 4H pencil over a view box using trans illuminated light in a dark room and any stray light radiations were eliminated. Cranial registration marks were traced on the acetate tracing sheets after marking them on the cephalogram. Only Good qualities of lateral cephalograms were taken for the study.

If the right and left structural outlines were lacking in superimposition on each other, then the average between the two was drawn by inspection and there after cephalometric points were located to the arbitrary line so obtained. The linear and angular measurements were made to the nearest 0.5 mm and 0.5° respectively with the help of scale and protractor.

Statistical analysis
Reliability of measurement was tested by doing double determinations test and no statistically significant differences was observed. The Dentoalveolar linear and angular measurements (Fig. 5,6) have been measured over the tracing of lateral head Cephalogram and the Mean values and Standard Deviation of different angular and linear variables were calculated within each Group. There after inter-group comparison of dentoalveolar angular and linear measurements were done by student's 't' test. The statistically significant levels were predetermined at P <0.05, P <0.01, and P <0.001.

RESULTS
Mean and standard deviation values of the Control group, Group-I (skeletal Class-I malocclusion), Group-II (skeletal Class-II malocclusion) and Group-III (skeletal Class-III malocclusion) for the dentoalveolar angular measurement (in degree) and linear measurement (in mm) parameters are presented in Table-I. The statistical comparisons of Control group and malocclusion groups are presented in Table-II and inter group comparison of malocclusion groups are presented in Table-III.

Among the Dentoalveolar angular variables (Bar Diagram-1(a),1(b)) the mean value of the Max.1toNA found to be very significantly higher in Group-III (p<0.001) and just cantly higher in Group-II (p<0.05) as compared to Control Group and Group-I. Max.1 to SN, found to be very significantly in Group-III (p<0.001) as compared to Control Group and Group-I while Max.1-Mand.1 (Inter-incisal angle) found to be lower very significantly in Group-II (p<0.001) as compared to Control Group and Group-I. Md.1-NB found to be very significantly higher in Group-II (p<0.001) as compared to Group-I and just significantly higher in Group-II (p<0.05) as compared to Control Group while Md.1-NB found to be very significantly lower in Group-III (p<0.001) as compared to Control Group and significantly lower in Group-III (p<0.01) as compared to Group-I. Md.1-MP (IMPA) found to be very significantly higher in Group-II (p<0.001) as compared to Group-I and significantly higher in Group-II (p<0.01) as compared to Control Group while Md.1-MP (IMPA) found to be very significantly lower in Group-II (p<0.001) as compared to Control Group and Group-I. S-N-IId. found to be significantly higher in Group-III (p<0.01) and very significantly lower in Group-II (p<0.001) as compared to Control Group while S-N-IId. found to be very significantly higher in Group-III (p<0.001) and lower in Group-II (p<0.001) as compared to Group- I. OP-SN found to be very significantly higher in Group-II (p<0.001) as compared to Control Group.
Among the Dentalocclusal linear variables (Bar Diagram-2) Max.1 to NA significantly higher in Group-II and Group-III (p<0.01) as compared to Control Group and just significantly higher in Group-III (p<0.05) as compared to Group-I. Max.1 to N-pog found to be very significantly higher in Group-II (p<0.001) and very significantly lower in Group-III (p<0.001) as compared to Control Group and Group-I. Md.1 to NB found to be very significantly lower in Group-III (p<0.001) as compared to Group-I and found to be significantly higher in Group-II (p<0.01) as compared to Control Group while found to be just significantly lower in Group-III (p<0.05) as compared to Control Group. Md.1 to N-pog, found to be just significantly higher in Group-II (p<0.05) as compared to Control Group and found to be just significantly lower in Group-III (p<0.05) as compared to Control Group and Group-I. Maxillary alveolar depth (MdAD) found to be just significantly lower in Group-II (p<0.05) as compared to Control Group and Mandibular alveolar depth (MdAD) found to be just significantly lower in Group-III (p<0.01) as compared to Control Group and just significantly lower in Group-III (p<0.05) as compared to Group-I.

**DISCUSSION**

Evaluation of dentalocclusal compensation in different skeletal patterns may be useful to know the limit of the natural dentalocclusal compensation, treatment planning, treatment success and for post-treatment stability. Solow (1966), Björk and Skieller (1972); Ishikawa et al., 2000 have suggested that malocclusions result from insufficient dentalocclusal compensation to variations in facial patterns.

The age group considered in this study was 15-24 years with the mean age 19.5 years, which represented a stable period in the growth and development of craniofacial complex. The skeletal malocclusions were divided on the basis of Wit’s analysis (A. Jacobson, 1975)\(^7\), APP-BPP measurement (Ram S.Nanda and Robert M.Merrill, 1994)\(^1\) and β-angle measurement (Chong Yol Baik and Maria Ververidou, 2004)\(^3\) Collectively for better understanding of skeletal pattern. The use of occlusal plane was, supported in earlier studies by Jenkins (1955)\(^6\), Moore (1959)\(^9\)and Harvold (1963)\(^10\).

In the investigation undertaken by Nanda and Merrill in (1994)\(^1\), the distance between the projections from points A and B on the palatal plane was found to be the best indicator of sagittal jaw relationship. Now Beta angle (Chong Yol Baik and Maria Ververidou, 2004)\(^4\) used for assessment of skeletal dysplasias with great success as does not depend on any cranial landmarks or dental occlusion.

The present study shows that the Max.1 to NA (Angle) increased in Group-III (Skeletal Class-III)\(^{(31.28±5.21)}\) when compared with skeletal Class-I pattern (23.60±6.05) As reported by Holdaway (1956)\(^11\) a compensatory mechanism allowed a good occlusion to be achieved in a subject with an acceptable facial balance related to various skeletal apical bases. This relationship is achieved by relative tipping of incisors and change in occlusal plane.

Similarly Coben (1955)\(^12\) and Bibby (1980)\(^13\) reported that to reduce the anteroposterior discrepancy between maxillary and mandibular apical bases, Class-III cases tried to achieve proclined maxillary incisors. As opposed to the present study the proclination of maxillary incisors decreased in Class-III by Denovan’s (1954)\(^14\).

In the present study for Max.-1 to SN (angle) highly significant difference (p<0.001) in mean value were found between Control Group (106.60±5.04) with Group-I (112.64±6.40), Group-I (106.03±6.14) with Group-III (112.64±6.40).

Similar results were found by Bibby (1980)\(^13\) He also found that upper incisors inclination was significantly different between all three skeletal Class-I, Class-II, Class-III malocclusion. According to him skeletal Class-III malocclusion have relatively proclined upper incisors and skeletal Class-II having relatively retroclined maxillary incisors.

On the other hand, Ishikawa et al., (1999)\(^8\) reported that the upper incisors inclined more labially in negative overjet cases and upper 1 to SN is most appropriate method of describing dental compensation quantitatively. Similarly Antonija and Vorga (2003)\(^15\) suggested upper incisors protrusion in relation to maxillary base in subjects with mandibular prognathism. These findings suggested that the proclination of upper incisors as a result of dentalocclusal adaptation, which is characteristic for Class-III relationship also supported the present study.

In the present study statistically significant difference to a level of p<0.01 were found for Max.1 to NA (Linear) measured when comparison made between Control Group (6.64±1.34) with Group-II (7.53±2.95), between Control Group (6.64±1.34) with Group-III (8.02±2.83). The findings of present study indicated that upper incisors are positioned forward in relation to N-A line in skeletal Class-II and skeletal Class-III malocclusion as compare to Control Group, which proves the proclination of maxillary incisors.
In the present study no statistically significant difference was found in mean value of Max.1 to NA (Linear) between Group-II (7.53±2.95) and Group-III (8.02±2.83), which indicated that maxillary incisors are positioned forward in Class-II and Class-III malocclusion in relation to N-A line in maxilla. In Class-II malocclusion maxilla is positioned forward while in Class-III malocclusion maxilla is positioned backward in relation to cranial base but linear distance between upper incisors and N-A line shows no statistically difference in mean value between Class-II and Class-III malocclusion, that proves dento-alveolar compensation in class-III malocclusion.

The findings of study of Ismail Ceylan (2003) also supported the results of present study. According to him Max to N.A (mm) measurement showed statistically significant difference among the different overjet (positive and negative overjet) groups. Mayury Kuramae (2005) also evaluated high mean value of Max I to NA (Linear) for skeletal Class-III malocclusion, reflected a dental compensation, which also supports the present study.

In the present study Max.1 to N-Pog (Linear) value between Control Group and malocclusion groups were found very highly significant at the level of 'p' <0.001 between Control Group (10.20±2.64) with Group-II (14.39±3.41) between Control Group (10.20±2.64) with Group-III (8.80±4.49), between Group-I (10.10±3.18) with Group-II (14.39±3.41), between Group-I with Group-III, between Group-II with Group-III.

Similarly Riedel (1952) measure the anterioposterior position of the upper incisor to the facial plane. That was recorded with an average of between 5.5 and 6.5mm in Patient exhibiting normal occlusion. In class III malocclusion maxillary incisors were found far behind this point. Maxillary incisor were found about twice the distance anterior to the facial plane in the patients having class-II,div1 malocclusion.

In the present study when intergroup comparison were made between Control Group (normal occlusion) and various malocclusion groups. The differences in mean value of Md.1 to NB angular variable found were highly significant (p<0.001) between Control Group (28.10±4.86) with Group-III (20.96±8.61) between Group-II (30.33±6.63) with Group-III (20.96±8.61). The difference in mean value of Md.1 to NB angular variables were also significant (p <0.01) between Group-I (26.23±5.94) and with Group-II (30.33±6.63), between Group-I (26.23±5.94) with Group-III (20.96±8.61).

The present study is supported by Marcos Roberto et al., (2005) on skeletal Class-II malocclusion. According to him the angular measurements of the mandibular incisors to NB present statistically significant difference, showing mandibular incisors labially inclined.

The study of Bibby R.E. (1980) also supported the present study, according to him a consistent pattern appears to be operating which retroclines the lower incisors in the protrusive mandible of Class-III types. The pattern of lower incisors in Class-II malocclusion is proclination of lower incisors than Class-I malocclusion.

In the present study very high significant difference for Md.1 to MP at the level of <0.001 were found when the mean values of Group-III (65.84±11.62) were compared with Control Group (97.86±4.34), Group-I (94.95±7.28) and Group-II (101.28±5.13). There is also significant difference to a level of p<0.01 between Control Group (97.86±4.34) with Group-II (101.28±5.13).

Ismail Ceylan (2003) who proved in their studies that Mand.1 to MP angle statistically significant different among different overjet pattern. Bibby (1980) evaluate L1 to Md. plane angle in various skeletal pattern Class-I (94.45±7.30) Class-II (97.14±7.39) and Class-III (89.28±6.90).

Similar results were found by Antaniya & Varga (2003), they stated that IMPA angle represents the degree of protrusion and retrusion of lower incisors in relation to mandibular base. In relation to eugnathic patient (920), patients with mandibular prognathism have statistically significant value of decreased for this angle (83.540) as a result of dentoalveolar adaptation. Tweed (1954) stated that the position of the lower incisor is vertical for a stable maxillo-mandibular relationship and their position in relation to the mandibular base which should be 90, is of great importance.

In the present study Md.1 to SN shows statistically very highly significant difference (p<0.001) in mean value when intergroup comparison were made between Control Group (52.18±6.53) with Group-II (44.95±6.88), and Group-III (62.40±9.51), between Group-I (52.53±7.21) with Group-II (44.95±6.88), and Group-III (62.40±9.51) between Group-II (44.95±6.88) with Group-III (62.40±9.51). That is mandibular incisors are very proclined labially in skeletal Class-II malocclusion, while these were found upright or retroclined in skeletal Class-III malocclusion, Which was similar to the results found by Ohyama (1978), R.B. Bibby (1980), Sebata et al., (1969) who proved in their studies that lower incisors are relatively upright or retroclined in Class-III malocclusion due to dentoalveolar compensation.
Ishikawa and Nakamura (2000) evaluated the dentoalveolar compensation in negative overjet cases by measuring SN-1.1 angle. The SN-1.1 angle for normal overjet group were (56.30±6.30) while for negative overjet were (60.40±9.20) these finding supports the present study. Shim H.Y. and Chang Y.H. (2004) were also found increased L1 to SN angle in mandibular prognathism that is retroclined lower incisors. This study also supports the present study.

Highly significant statistically difference (p≤0.001) in Md.1 to NB (linear) were found, When comparison of Group III (5.20±2.49) were made with Group I (6.93±2.19) and Group II (8.01±2.86). While significant difference (p≤0.01) were found between control group with Group II. These findings indicated forward positioning of mandibular incisors in skeletal classII malocclusion and backward positioning in skeletal classIII malocclusion. This was supported by Antonija and Vorga (2003) who found that the value of Md.1 to NB linear (3.35mm) suggest the retrusion of mandibular incisors in relation to mandibular apical base, in mandibular prognathic patients, because the value for eugnathic patients is 4.5mm. It is also a part of dentoalveolar compensation.

The present study showed significant (p≤0.01) difference in Md.1 to N pog (linear), when comparison were made between Group-II (6.46±3.80) with Group-III (4.00±2.86) while just significant differences were found in mean value between control Group(5.02±2.47) and with Group-II, between control Group with Group-III, between Group-I(5.90±2.69) with and Group-III. Findings suggested the forward positioning of mandibular incisors in Class-II malocclusion and backward positioning of mandibular incisors in Class-III malocclusion as a dental compensation.

In the present study, Highly significant difference in the mean values of Max.1- Mand.1 (interincisal angle) being found at the level of 'p'<0.001, when Group-II (116.25±10.16) compared with Control Group (127.51±7.22), Group-I (127±10.94) and Group-III (130.24±12.50).

As the interincisal angle shows a decrease value in Group-II (skeletal Class-II malocclusion) and increase in Group-III (Skeletal Class-III malocclusion) as compared to Control Group and Group-I. This was supported by Ismail Ceylan (2003), who found that measurements of interincisal angle showed statistically significant, decrease in positive overjet groups and increase in interincisal angle in negative overjet groups. The present study is also supported by Antonija and Varga (2003) in their investigation a mean value of interincisal angle 136.130 for prognathic patients and mean value of 131.50 for eugnathic patients. The interincisal angle was more in the study of Antanija & Vorga than the present study probably due to different racial and ethnic groups.

In our study, when intergroup comparison were made between Control Group, Group-I, Group-II and Group-III for angular variable S-N-Pr. The mean value of S-N-Pr did not show any statistically significant difference in between groups. S-N-Pr angle remain almost same in all sagittal skeletal pattern by the high capacity of adaptation of the alveolar structure between upper central incisor teeth.

The present study is supported by Tallgren and Solow (1991) they concluded that alveolar structure is a flexible area located between the facial skeletal and occlusal dynamics. Alveolar structure tries to establish and maintain normal relationship in different skeletal displasias. This is so called "dentoalveolar compensatory mechanism" spontaneously made skeletal deviation. On the other hand the alveolar structure is also instrumental in controlling development of the jaws. The high capacity of adaptation of the alveolar structure accounts for the fact that it does not only change with skeletal maturation (Mirzen Arat, 2001).

S-N-Id angle shows very high statistically significant difference in mean value when comparison is made between Control Group (83.37±3.68) with Group-II (78.83±3.37), between Group-I (81.90±3.75) with Group-III (78.83±3.37), between Group-I and Group-II (81.90±3.75), with Group-III (86.18±4.45), between Group-II and Group-III (86.18±4.45).

In skeletal Class-II malocclusion S-N-Id angle is smaller as compare to Control Group and Class-I malocclusion due to mostly retrognathic mandible as compare to cranial base. In skeletal Class-II malocclusion very much positive overjet indicates inadequate dentoalveolar compensation. Infradental, the alveolar point which is present in mandible in severe skeletal Class-II malocclusion mandible is positioned much backward in relation to nasion point. So, S-N-Id angle is small in Class-II malocclusion and dento-alveolar compensation is not properly attained.

In skeletal Class-III malocclusion S-N-Id, is large, which is due to forward position of mandible as compare to cranial base. In skeletal Class-III malocclusion there are chances of edge-to-edge bite or negative overjet presence and alveolus (Infradental) placed forwardly. So, increased S-N-Id angle in Class-III malocclusion indicate inadequate dento-alveolar compensation.
OP-SN plane angle value between Control Group (12.77±3.96) with Group-II (17.09±4.45) were found highly significant at a level of 'p' <0.001. Which indicate severe canting of occlusal plane in relation to cranial base. Thiscanting of occlusal plane may be because of dento-alveolar compensation to attain normal occlusal and incisal relationship.

This is supported by the study of Ishikawa and Nakamura (2000)32 indicated that for sagittal jaw discrepancies normal incisor relationship can be attained by a combination of compensatory effects of the incisor inclination and occlusal plane angulation. This suggests the clinical importance of changing the occlusal plane angulation in non-surgical treatment of skeletal malocclusion.

Similarly Mitsui Miyuki (2001)33 was also studied that cant of occlusal planes were strongly related to sagittal jaw relationship and played an important role in dento-alveolar compensation to obtain a normal incisor relationship and a Class-I molar relationship.

Maxillary alveolar depth (Mx.AD) is a distance between shortest line above apex of maxillary central incisors to maxillary mid sagittal labial and palatal alveolar cortical bone (Beckmann 1998)27 (fig-4). The mean value of Mx.AD in control Group was 15.5±4.00 in the present study.

When the mean and standard deviation values of Mx.AD were compared in present study between Control Group with Group-I, Group-II with Group-III (malocclusion groups) the results were found to be almost insignificant in all intergroup comparison except in Group-II (skeletal Class-II malocclusion) at a level of 'p' <0.05.

The present study is supported by Ismail Ceylan (2003)16, who studied Mx.AD in various overjet Groups and found that Mx.AD does not shows statistically significant difference in between different overjet groups.

Mandibular alveolar depth (Md.AD) is distance between shortest line at apex of mandibular central incisors between mandibular mid sagittal labial and lingual alveolar cortical bone. (Beckmann et al., 1998)37. Mean and standard deviation value of Md.AD in Control Group was 9.29±1.71 in the present study.

When inter group comparison were made for Md.AD in present study between control group, Group-I, Group-II and Group III, the mean value of Ma.AD shows statistically significant difference in Group-III (skeletal Class-III malocclusion) at a level of 'p' <0.01 as compared to Control Group.

The findings of present study supported by Alka Singh (2003)18, who found no difference in Md.AD in Class-I and Class-II div.1 malocclusion. The significant difference in mean value of Group-III (7.76±2.36), Control Group (9.29±1.71) was supported by Nojima K. (1998)29 and Guo XX, & Wang CL. (2005)30 who demonstrated decreased Mx.AD and in lingual inclination of symphysis in Class-III malocclusion.

Maxillary anterior alveolar and basal height (Mx.AABH) is linear distance between mid point of alveolar meatus of maxillary central incisor and intersection between palatal plane and maxillary alveolar axis (Beckmann et al., 1998)27.

When inter-group comparison were made for Mx.AABH, in present study between Control Group, Group-I, Group-II and Group-III. Mean of Mx.AABH did not show any statistically significant difference but shows a trend to less Mx.AABH in Class-III malocclusion and high value in Class-II malocclusion.

The findings of present study is supported by Ismail Ceylan (2003)16, Hua YM, Zhao BJ (2006)31 and Bulent Baydas (2004)32, who suggested a increase Mx.AABH in positive overjet cases and decrease Mx.AABH in negative overjet cases. The findings are not significant in present study probably due to low sample size.

Mandibular anterior alveolar and basal height (Md.AABH) is distance between mid point of alveolar meatus of mandibular central incisors and intersection between symphysial surface and mandibular alveolar axis. (Beckmann et al., 1998)27.

When inter group comparison were made between control Group, Group-I, Group-II and Group-III no statistically significant difference were found in mean value of Md.AABH in the present study. This study indicated that Md.AABH is not affected by skeletal dysplasias.

The results of present study is similar as work done by Ismail Ceylan (2003)16, who studied Md.AABH in different overjet pattern and found no statistically significant difference in mean value of Md.AABH when intergroup comparison were done between different overjet groups.

Dentoalveolar compensation is mostly represented by proclination of upper and retroclination of lower dentoalveolar segment in skeletal Class-III malocclusion and proclination of upper and proclination of lower dentoalveolar segment in skeletal class II malocclusion. Although presence of this compensatory process abnormal incisal relationship develops due to inadequate dentoalveolar compensation.
The present study was cross-sectional and soft tissue compensation was not considered. A further study with separate male and female samples may be more informative for both sexes. Abnormal Muscle activities and functions like mouth breathing, tongue thrust, short lips and lip trap etc. should be investigated during development of skeletal dysplasias and malocclusion.

CONCLUSION

From this study, following conclusions may be drawn:

1. Dentoalveolar compensatory changes in the position and axial inclination of the upper and lower incisors were found in Group-II (skeletal Class-II malocclusion) and Group-III (skeletal Class-III malocclusion).

2. In Group-II (skeletal Class-II malocclusion) upper incisors are proclined in the upper jaw, and lower incisor proclined in lower jaw.

3. In Group-III (skeletal Class-III malocclusion) a consistent pattern appears to be operating which retroclined the lower incisors and at the same time proclined the upper incisors as a compensatory process.

4. OP-SN found to be significantly higher in Group-II (skeletal Class-II malocclusion).

5. Maxillary alveolar depth (Mx.AD) found to be less in Group-II and Mandibular alveolar depth (Md.AD) found to be less in Group-III as compared with Control Group.

REFERENCES


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**Fig. 1 : Method's Used for Skeletal Pattern**

**Fig. 2 : Landmarks Used in the Study**
Fig. 3: Landmarks Used in the Study

Fig. 4: Reference Planes Used in the Study

Fig. 5: Angular Measurements

Fig. 6: Linear Measurements (in mm)
Bar Diagram - 1(a):
Comparison of Dentoalveolar Angular Variables between Control Group and Malocclusion Groups (Group-I, Group-II, Group-III)

Bar Diagram - 1(b):
Comparison of Dentoalveolar Angular Variables between Control Group and Malocclusion Groups (Group-I, Group-II, Group-III)

Bar Diagram - 2:
Comparison of Dentoalveolar Angular Variables between Control Group and Malocclusion Groups (Group-I, Group-II, Group-III)
Table-I: Mean and SD of Dentoalveolar Angular and Linear Variables in Different Groups

<table>
<thead>
<tr>
<th>S. No.</th>
<th>VARIABLES</th>
<th>CONTROL GROUP (N = 35)</th>
<th>GROUP- I (N = 35)</th>
<th>GROUP- II (N = 35)</th>
<th>GROUP- III (N = 25)</th>
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<td>1.</td>
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<td>4.</td>
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<td>85.32 &amp; 4.27</td>
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<td>6.</td>
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<td>94.95 &amp; 7.28</td>
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<td>85.84 &amp; 11.82</td>
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<td>7.</td>
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<td>52.53 &amp; 7.21</td>
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<td>78.83 &amp; 3.37</td>
<td>86.18 &amp; 4.45</td>
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<td>3.80 &amp; 4.49</td>
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<td>15.</td>
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<td>7.76 &amp; 2.36</td>
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<td>17.</td>
<td>Mandibular anterior alveolar and basal height (MdAABH)</td>
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<td>33.06 &amp; 3.50</td>
<td>33.24 &amp; 2.85</td>
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Table-II: Descriptive statistics and Comparison in control Group and malocclusion Groups

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<td>24.14 (3.37)</td>
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<td>108.80 (7.77)</td>
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<td>106.60 (5.04)</td>
<td>112.64 (6.40)</td>
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<td>127.51 (7.22)</td>
<td>116.25 (10.16)</td>
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<td>&lt;0.001***</td>
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<td>6.</td>
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<td>101.28 (5.13)</td>
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<td>7.</td>
<td>Md. 1 to SN</td>
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<td>21.24 (2.65)</td>
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DENTOAVERSEAL ANGULAR MEASUREMENTS (in degree)

DENTOAVERSEAL LINEAR MEASUREMENTS (in mm)

Just Significant "p"<0.05, Significant **"p"<0.01, very significant ***"p"<0.001
Table III: Descriptive statistics and intergroup Comparison of malocclusion Groups

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<td>101.28 (5.13)</td>
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DENTOALVEOLAR ANGULAR MEASUREMENTS (in degree)

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<td>and basal height (MxAABH)</td>
<td>21.13 (3.3)</td>
<td>21.34 (3.11)</td>
<td>19.56 (4.64)</td>
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<tr>
<td>17</td>
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<td>33.06 (3.50)</td>
<td>33.24 (2.85)</td>
<td>32.32 (3.76)</td>
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DENTOALVEOLAR LINEAR MEASUREMENTS (in mm)

*Just Significant **p' <0.05, Significant ***p' < 0.01, very significant ****p' <0.001*