

CORRELATING POSITION OF HYOID BONE AND MANDIBLE TO THE THIRD CERVICAL VERTEBRAE IN PATIENTS WITH CLASS I, II AND III SKELETAL MALOCCLUSION- A RETROSPECTIVE CEPHALOMETRIC STUDY

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ABSTRACT

BACKGROUND

Hyoid bone is also been called the skeleton of the tongue. Its origin lies within the second and third pharyngeal arch cartilages.

Hyoid bone is unusual in that it relates with no other bone, it is suspended by means of muscular, ligamentous and fascial attachments of the mandible, pharynx, and craniospinal complex.

By virtue of all these attachments hyoid bone is important in many aspects, such as balancing head on the spinal cord , prevention of regurgitation of bolus, opening of the oral cavity, maintenance of stability and patency of the pharyngeal airway.

Hyoid bone position can be studied with the help of lateral cephalogram. Bibby has introduced “HYOID TRIANGLE” to determine the anteroposterior position of hyoid bone with reference to third cervical vertebra and mandible. The relationship between the hyoid bone and mandible is maintained from the age of three years. Thus the anteroposterior position of hyoid bone is used to asses normal physiologic position and functions of the surrounding anatomy in this area, which is important in orthodontic and surgical relapse.

The triangle is formed by joining the cephalometric points retrognathion (the most inferior point on the mandibular symphysis), hyoidale (the most superior, anterior point on the body of the hyoid bone), C3 (the most inferior, anterior position on the third cervical vertebrae).

The aim of the present study is to investigate the antero-posterior position of hyoid bone to mandible and third cervical vertebra in class I, class II, and class III skeletal malocclusion patients. The objective is to,

1. Establish a control norm for antero-posterior position of hyoid bone to third cervical vertebra in class I skeletal malocclusion patients and to determine hyoid bone position in class II and class III skeletal malocclusion.
2. Correlate the position of hyoid bone in skeletal class II and class III with that of the established control norm and to find out if there is any difference in hyoid bone position with reference to third cervical vertebra among them
3. To establish a ratio of hyoid bone position and retrognathion to cervical vertebra and determining if it is a constant in various skeletal malocclusion groups.

RESULTS

The mean distribution among the individuals in study with respect to C3- RgN measurement was 70.2mm in Class I skeletal malocclusion, 67.81mm in Class II skeletal malocclusion and 74.29mm in Class III skeletal malocclusion.

The mean distribution among the individuals in study with respect to C3-H measurement was 32.95mm in Class I skeletal malocclusion, 31.76 mm in Class II skeletal malocclusion and 34mm in Class III skeletal malocclusion.

The mean hyoid ratio among the individuals in study was 2.15 in Class I skeletal malocclusion, 2.14 in Class II skeletal malocclusion and 2.2 in Class III skeletal malocclusion.

Very negligible to weak correlation of the variables between group I & II, I & III and II & III.

Descriptive statistics were expressed as means and standard deviation. Comparison of the study variables between the three groups was done using One Way ANOVA test followed by post hoc Bonferroni test for pairwise comparison. Correlation amongst the study variables was done using Pearsons correlation test. In the above tests, p value less than or equal to 0.05 was considered to be statistically significant. Interpretation of the correlation coefficient was done as follows:

Size of Correlation	Interpretation
.90 to 1.00 (-.90 to -1.00)	Very high positive (negative) correlation
.70 to .90 (-.70 to -.90)	High positive (negative) correlation
.50 to .70 (-.50 to -.70)	Moderate positive (negative) correlation
.30 to .50 (-.30 to -.50)	Low positive (negative) correlation
.00 to .30 (.00 to -.30)	negligible correlation

Table no.1: Comparison of C₃- RgN measurement between the three study groups

C ₃ - RgN (mm)	Class I	Class II	Class III
Mean	70.20	67.81	74.29
Standard deviation	9.90	7.37	7.53
P value (One Way ANOVA test)	0.047*		

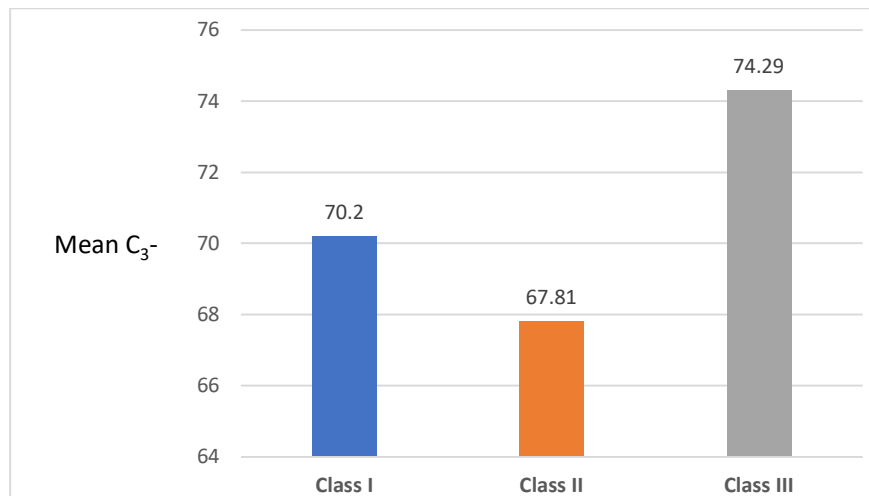
*p ≤ 0.05 is statistically significant

Table no.2: Pair wise comparison of C₃- RgN measurement

P value (Post hoc Bonferoni test)	Class I	Class II	Class III
Class I	-	1.000	0.377
Class II	1.000	-	0.044*
Class III	0.377	0.044*	-

*p ≤ 0.05 is statistically significant

Graph no.1: Comparison of C₃- RgN measurement between the three study groups



The mean distribution among the individuals in study with respect to C3- RgN measurement was 70.2mm in Class I skeletal malocclusion, 67.81mm in Class II skeletal malocclusion and 74.29mm in Class III skeletal malocclusion.

Table no.3 Comparison of C₃- H measurement between the three study groups

C ₃ - H (mm)	Class I	Class II	Class III
Mean	32.95	31.76	34.00
Standard deviation	5.71	3.90	4.95
P value (One Way ANOVA test)	0.342		

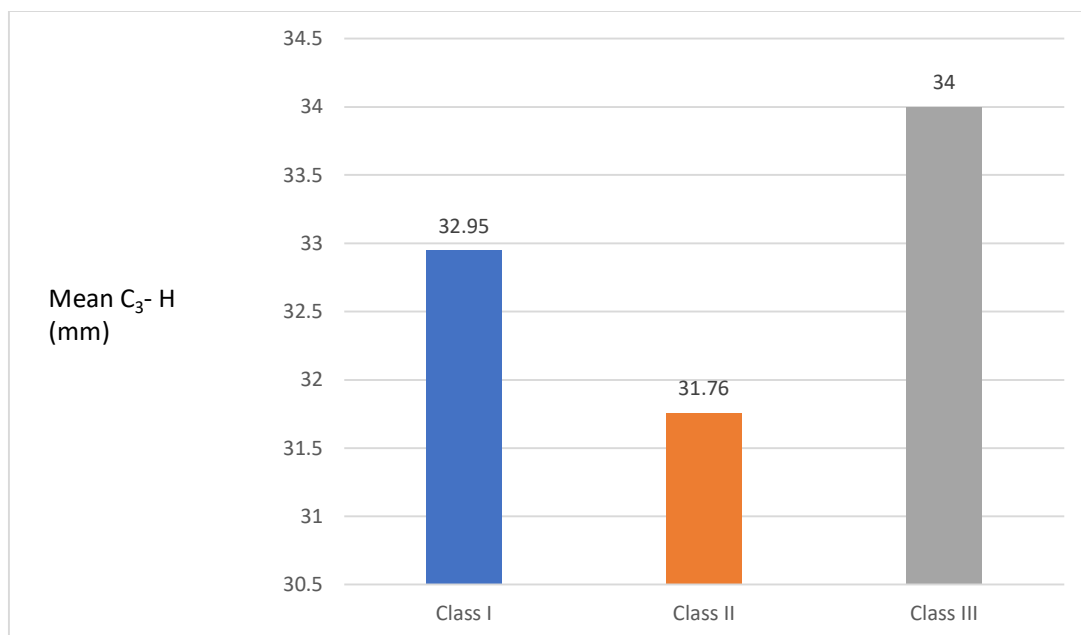
*p ≤ 0.05 is statistically significant

Table no.4: Pair wise comparison of C₃- H measurement

P value (Post hoc Bonferoni test)	Class I	Class II	Class III
Class I	-	1.000	1.000
Class II	1.000	-	0.435
Class III	1.000	0.435	-

*p ≤ 0.05 is statistically significant

Graph no.2: Comparison of C₃- H measurement between the three study groups



The mean distribution among the individuals in study with respect to C3-H measurement was 32.95mm in Class I skeletal malocclusion, 31.76 mm in Class II skeletal malocclusion and 34mm in Class III skeletal malocclusion.

Table no.5 Comparison of hyoid ratio between the three study groups

Hyoid ratio	Class I	Class II	Class III
Mean	2.15	2.14	2.20
Standard deviation	0.20	0.18	0.18
P value (One Way ANOVA test)	0.481		

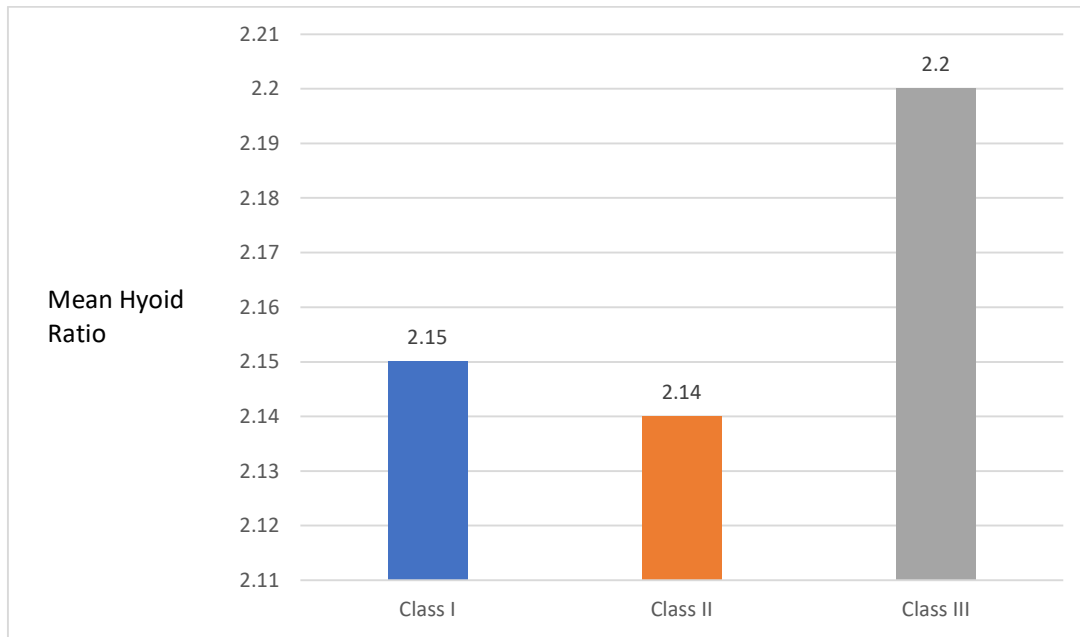
* $p \leq 0.05$ is statistically significant

Table no.6: Pair wise comparison of hyoid ratio

P value (Post hoc Bonferoni test)	Class I	Class II	Class III
Class I	-	1.000	1.000
Class II	1.000	-	0.788
Class III	1.000	0.788	-

* $p \leq 0.05$ is statistically significant

Graph no.3: Comparison of hyoid ratio between the three study groups



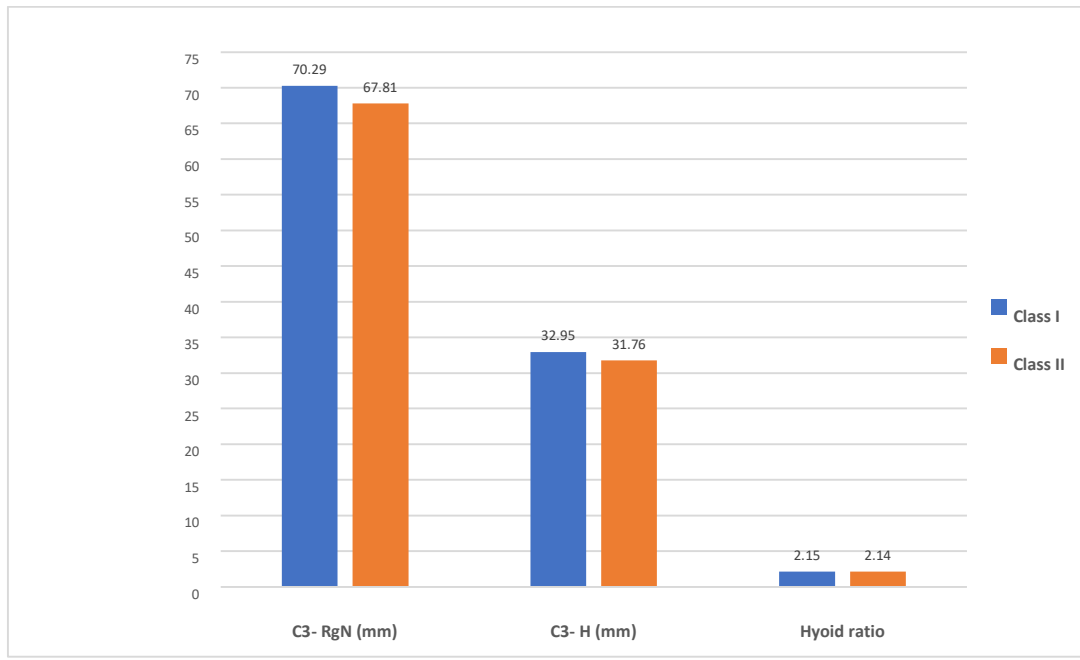
The mean hyoid ratio among the individuals in study was 2.15 in Class I skeletal malocclusion, 2.14 in Class II skeletal malocclusion and 2.2 in Class III skeletal malocclusion.

Table no.7: Correlation of C₃- RgN, C₃- H and hyoid ratio between Class I and Class II subjects

Mean ± SD	Class I	Class II	r (correlation coefficient)	P value (Pearson's correlation test)
C ₃ - RgN (mm)	70.29 ± 9.90	67.81 ± 7.37	-0.271	0.235
C ₃ - H (mm)	32.95 ± 5.71	31.76 ± 3.90	-0.396	0.076
Hyoid ratio	2.15 ± 0.20	2.14 ± 0.14	-0.261	0.253

*p ≤ 0.05 is statistically significant

Graph no.4: Correlation of C₃- RgN, C₃- H and hyoid ratio between Class I and Class II subjects



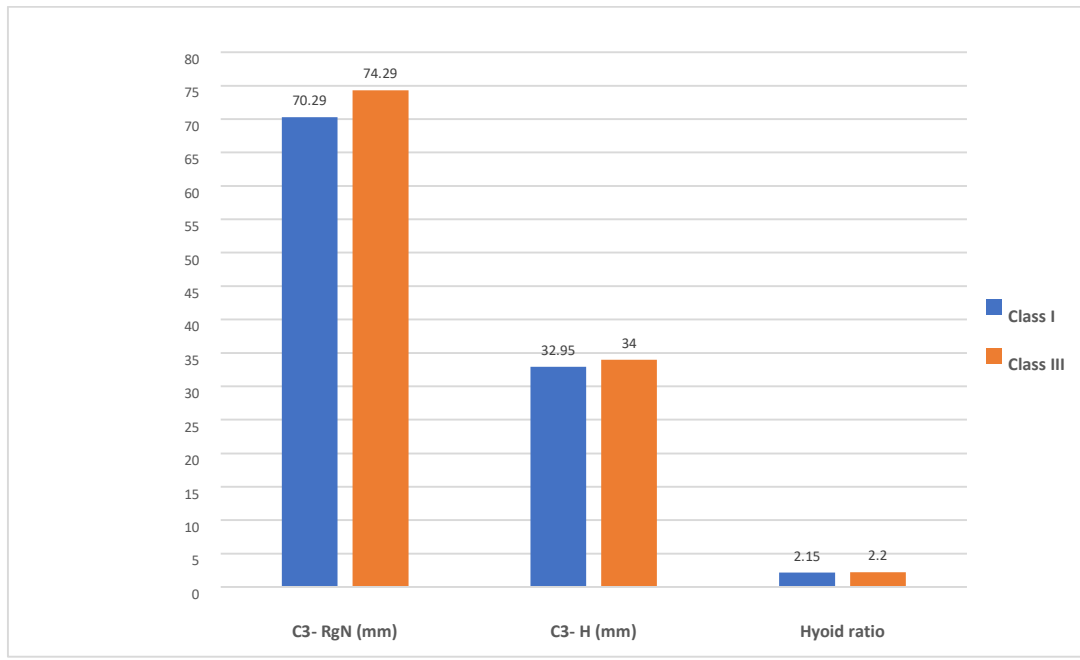
Very negligible to weak correlation of the variables between group I & II

Table no.8: Correlation of C₃- RgN, C₃- H and hyoid ratio between Class I and Class III subjects

Mean ± SD	Class I	Class III	r (correlation coefficient)	P value (Pearson's correlation test)
C ₃ - RgN (mm)	70.29 ± 9.90	74.29 ± 7.53	-0.089	0.701
C ₃ - H (mm)	32.95 ± 5.71	34.00 ± 4.95	-0.179	0.439
Hyoid ratio	2.15 ± 0.20	2.20 ± 0.18	-0.119	0.607

*p ≤ 0.05 is statistically significant

Graph no.5: Correlation of C₃- RgN, C₃- H and hyoid ratio between Class I and Class III subjects



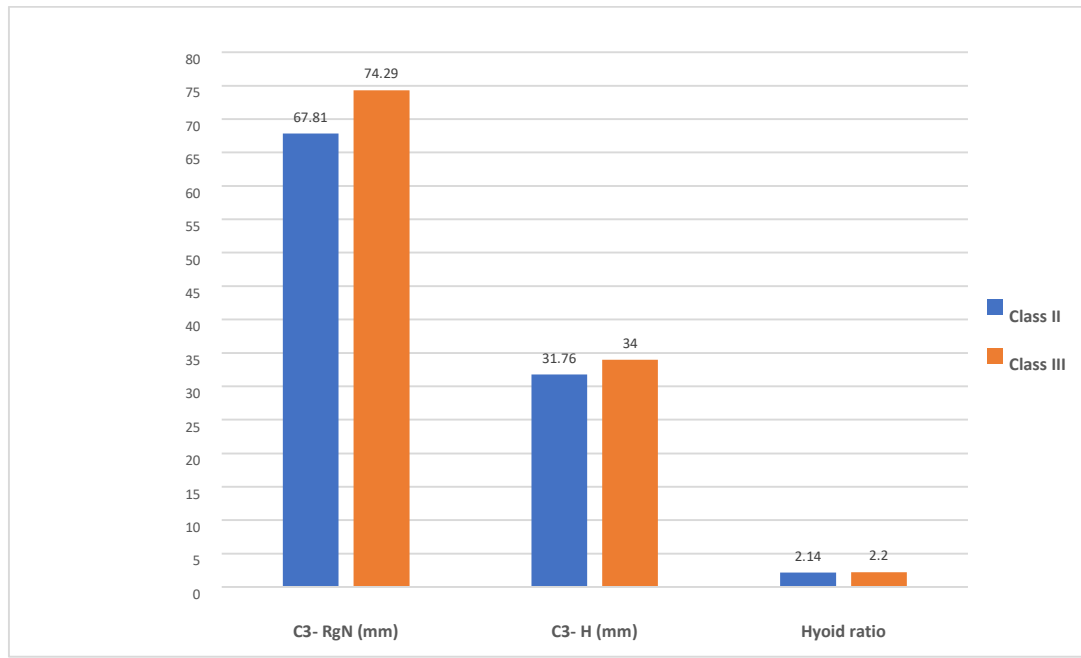
Very negligible to weak correlation of the variables between group I & III

Table no.9: Correlation of C₃- RgN, C₃- H and hyoid ratio between Class II and Class III subjects

Mean ± SD	Class II	Class III	r (correlation coefficient)	P value (Pearson's correlation test)
C ₃ - RgN (mm)	67.81 ± 7.37	74.29 ± 7.53	0.325	0.150
C ₃ - H (mm)	31.76 ± 3.90	34.00 ± 4.95	0.259	0.257
Hyoid ratio	2.14 ± 0.14	2.20 ± 0.18	0.068	0.771

*p ≤ 0.05 is statistically significant

Graph no.6: Correlation of C₃- RgN, C₃- H and hyoid ratio between Class II and Class III subjects



Very negligible to weak correlation of the variables between group II & III

CONCLUSION

The present study was carried out to establish a control norm in skeletal class I patients for hyoid bone position and to compare and correlate hyoid bone position with reference to third cervical vertebra and retrognathion of mandible in skeletal class I, class II and class III groups. Lateral cephalometric radiographs of 63 subjects were divided into three groups, i.e., group 1, skeletal class I malocclusion; group 2, skeletal class II malocclusion and group 3, skeletal class III malocclusion respectively.

Hyoid bone position is determined by using Hyoid triangle given by Bibby and Preston. Hyoid bone position is also compared and correlated in skeletal class I, class II and class III malocclusions by using Hyoid ratio which is obtained from hyoid triangle.

The hyoid ratio obtained is very similar in all the three skeletal malocclusion group studied with very minimal standard deviation denoting the anteroposterior change of hyoid bone position with relation to change in mandibular position.

The finding of this study has got significance with reference to oropharyngeal airway patency in skeletal class II malocclusions.

The following conclusions were drawn from this study,

- Standard values are given for the dimensions of the hyoid triangle.
- Hyoid bone is positioned more anteriorly in class III skeletal malocclusion subjects, and it is placed more posteriorly in class II skeletal malocclusion subjects when compared to skeletal class I group with reference to third cervical vertebra and Retrognathion of mandible.

REFERENCES

1. Bibby R E, Preston C B. 1981. The Hyoid triangle. American Journal of orthodontics and Dentofacial orthopedics 80: 92-97.
2. Adamitis PI, Spyropoulos NM.1983. The effects of lymphadenoid hypertrophy on the position of the tongue, the mandible and the hyoid bone. European Journal of Orthodontics 5 : 287-294.

3. Alan A. Lowe, John D. Santamaria, John A. Fleetham and Colin Price. 1986. Facial morphology and obstructive sleep apnea. *American Journal of Orthodontics and Dentofacial Orthopedics* : 484-491.
4. Alexander J. Wildman. 1961. Analysis of tongue, soft palate and pharyngeal wall movement. *American Journal of Orthodontics and Dentofacial Orthopedics* 47: 439-461
5. Amandeep Johal, Joanna M. Battagel. 1999. An Investigation into the changes in airway dimension and the Efficacy of Mandibular advancement appliances in subjects with obstructive sleep apnoea. *British Journal of Orthodontics* 26: 24-29
6. Anders Winnberg, Hans Pancherz and Per-Lennart Westesson.. 1994. Head Posture and hyo-mandibular function in man. A synchronized electromyographic and videofluorographic study of the open-close-clench cycle. *American Journal of Orthodontics and Dentofacial Orthopedics* 94: 393-404.
7. Anette M.C. Fransson, Ake Tegelberg, Bjorn A. H. Svenson, Bertil Lennartsson and Goran Isacson. 2002. Influence of mandibular protruding device on airway passages and dentoacial characteristics in obstructive sleep apnea and snoring. *American Journal of Orthodontics and Dentofacial Orthopedics* 122: 371-379.
8. Archilleos S. Krogstad. , Lyberg T . 2000 ; Surgical mandibular set back and changes in uvuloglossopharyngeal morphology and head posture ; a short –long –term cephalometric study in males 22 : 367-381
9. Archilleos S. Krogstad. 2000. Surgical mandibular advancement and changes in uvuloglossopharyngeal morphology and head posture; a short –long –term cephalometric study in males *European Journal of Orthodontics* 22: 383-394.
10. Athanasios E. Athanasiou, Nick Toutountzakis, Dimitrios Mavreas, Martin Ritzau and Ann Wenzel. 1991. Alterations of hyoid bone position and pharyngeal depth and their relationship after surgical correction of mandibular prognathism. *American Journal of Orthodontics and Dentofacial Orthopedics* 100: 259-265.