How to Cite:
Sharma, V. K. (2021). A relationship among dental crowding, maxillary and mandibular base lengths and naso-labial angle in untreated class I and class II subjects in mandi Gobindgarh population. *International Journal of Health Sciences*, *5*(S1), 343–351. https://doi.org/10.53730/ijhs.v5nS1.5663

A relationship among dental crowding, maxillary and mandibular base lengths and naso-labial angle in untreated class I and class II subjects in mandi Gobindgarh population

Vishal Kumar Sharma
Senior Lecturer, Department of Orthodontics & Dentofacial Orthopaedics, Desh Bhagat Dental College and Hospital, Desh Bhagat University Campus, Mandi Gobindgarh, Punjab, India
Email: vishaldentist@yahoo.co.in

***Abstract*---**Aims: A study was conducted to find out a relationship among maxillary and mandibular base lengths, dental crowding and naso-labial angle in untreated Class I and Class II subjects in Mandi Gobindgarh, Punjab, population. Study design: Cross sectional Place of Study: Department of Orthodontics and Dentofacial Orthopaedics, Desh Bhagat Dental College and Hospital, Desh Bhagat University Campus, Mandi Gobindgarh, Punjab. Methodology: This study included 60 pre-treatment lateral cephalograms and study models (28 class I & 32 class II) of untreated subjects with complete bilateral dental class I and complete bilateral dental class II malocclusion having all permanent teeth mesial to 1st molars & without any proximal decay and restorations. The maxillary and mandibular base lengths (Co-A and Co-Gn) and naso-labial angle were measured on pre-treatment lateral cephalogram & the tooth size-arch length discrepancies were measured on the pre-treatment dental casts. The measurements obtained from Class I and Class II subjects were further divided into two Groups each depending upon the severity of dental crowding. The obtained data was analyzed statistically with t-test and Pearson correlation coefficient (P=.05) to investigate any correlation between base length and dental crowding. Results: Patients with Class II malocclusion and moderate to severe crowding had significantly smaller maxillary and mandibular base lengths than subjects with same malocclusion and slight crowding. A weak inverse correlation was found between effective base lengths and severity of crowding. Positive correlations observed between NLA and maxillary and mandibular lengths were statistically not significant. Conclusion: Decreased maxillary and mandibular effective lengths constitute an

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2021.
***Corresponding author**: Sharma, V. K.; Email: vishaldentist@yahoo.co.in*
Manuscript submitted: 18 April 2021, Manuscript revised: 9 June 2021, Accepted for publication: 5 July 2021

important factor associated with dental crowding in patients with Class II malocclusion.

***Keywords*---**dental crowding, class I malocclusion, class II malocclusion, apical base length, nasolabial angle.

Introduction

Malocclusion has been seen to be associated with adverse physical, psychological and social effects including the longevity of the dentition and oral health and therefore, adversely affects the quality of life. Anterior crowding is one of the most common problems that motivate patients to seek orthodontic treatment[1].

Dental crowding occurs when the space required for the correct alignment of the teeth exceeds the space available in the dental arch. This usually results in rotated, ectopic, and/or impacted teeth. Dental crowding[1-13] can be defined as the deviation from the normal occlusion of the teeth due to the discrepancy in arch length and the tooth size. Many factors are found to be related to anterior dental crowding including arch width,[11-13] arch length,[10,14-16] mesio-distal tooth diameter[1,2,8,9,15,16] and dental proportions.[17-21]

Van der Linden et al (1974) classified crowding on the basis of its etiology as primary, secondary, and tertiary. He defined primary crowding as an inherent discrepancy between tooth size and the available arch length, which is mainly of genetic origin. Secondary crowding is caused by environmental factors influencing the dentition, such as caries and extractions. Tertiary crowding or late crowding occurs in the post-adolescent age. Many studies has been conducted (table 1) in the past on the anterior crowding and mandibular length. In general, patients with Class II malocclusion have a smaller mandibular length than subjects with normal occlusion and Class I malocclusion. Additionally, some cephalometric features[22,23] are associated with greater amount of dental crowding.

In general, patients with Class II malocclusion have a shorter mandibular length than patients with Class I malocclusion and normal subjects.[24-27] Improvement of facial profile is always a part of the general protocol in the management of malocclusion. Nasolabial angle is a major determinant in the soft tissue profile[28]. Nasolabial angle is one of the soft tissue cephalometric parameters analyzed in detail in orthodontic and ortho-surgical cases.[29] Orthodontic treatment involves the analysis of a number of soft tissue and hard tissue cephalometric parameters, which includes the nasolabial angle and effective maxillary and mandibular base lengths.[30-34]

Table 1

S no.	Year	Reference	Inference
1.	1972	Peck & Peck[14]	Conducted a study to find out whether the naturally well aligned mandibular incisors possess a distinctive dimensional characteristics. The results indicate that naturally well-aligned mandibular incisors do possess distinctive dimension characteristics, mesio-distaly and facio-lingualy. Comparison with crown dimensions of other population group also corroborate these findings.
2.	1989	Bishara et al[11]	longitudinal study was carried to determine the association between the changes in the maxillary and mandibular Tooth Size Arch Length Discrepancies (TSALD), and various dentofacial variables. it was found that mesio-distal diameter of different teeth and the changes in anterior and posterior facial heights were associated with the changes in the maxillary and mandibular tsald.
3.	2004	Turkkahraman H, Sayin MO.[22]	Observed that that crowding of the mandibular incisors is not only a tooth-arch size discrepancy, dentofacial characteristics also contribute to this misalignment. It was determined that patients with crowding had smaller lower incisor to NB angles, maxillary skeletal lengths, mandibular skeletal length, and mandibular dental measurements.
4.	2005	Sayin MO, Turkkahraman H.[23]	A cephalometric study was carried out to find a correlation between craniofacial features and severity of class ii malocclusion. It was found that cranial base angle was significantly larger in class ii div 2 malocclusion. Anterior and posterior cranial lengths were significantly shorter.
5.	2011	Janson et at [1]	Reported an inverse correlation between the apical base effective lengths and dental crowding, and also a positive correlation between maxillary and mandibular effective lengths.
6.	2014	Suja Ani G, Babu E.C.[36]	Found a positive correlation between NLA and Sl, Se, Co-A and Co-Gn. Also a statistically significant difference was observed between males and females in Se, Co-A,Co-Gn.

Therefore, the objective of this study was to evaluate a correlation of maxillary and mandibular base lengths to the amount of anterior crowding on the untreated subjects of Class I and Class II malocclusion in Mandi Gobindgarh population. The study also intended to find a correlation between the soft tissue profile i.e nasolabial angle and the effective maxillary and mandibular base lengths in Class I and Class II untreated subjects in Mandi Gobindgarh population.

Material and Methods

Sources of the data

Pre-treatment dental casts and lateral cephalograms of the patients visiting the Department of Orthodontics and Dentofacial Orthopaedics, Desh Bhagat Dental

College and Hospital, Desh Bhagat University Campus, Mandi Gobindgarh, Punjab

Method of collection of data

Pre-treatment study casts and lateral cephalograms of adequate number of patients demonstrating Class I and Class II malocclusion were evaluated. Tooth size and arch length measurements were obtained from the study casts using round soft brass wire, divider, scale and marking pencil. Lateral cephalograms of the patients were traced on Acetate matte tracing paper (0.003 inches thick) with 3H drawing pencil.[33] Linear and angular measurements were taken using geometric set squares and protractor.(figure 1)

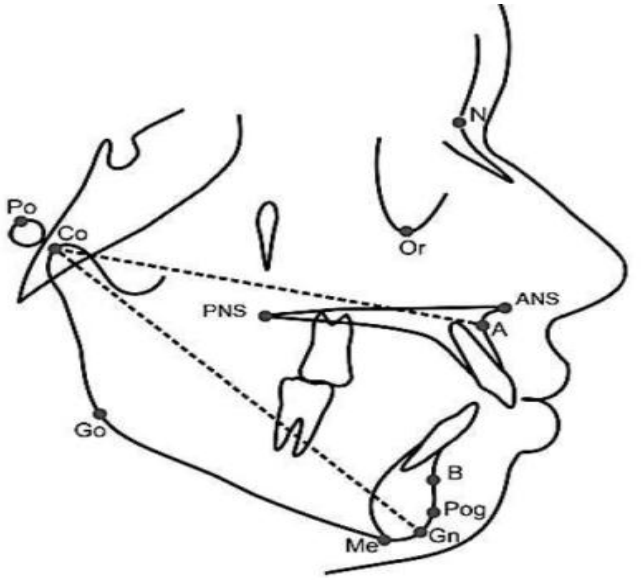

Figure 1 : Cephalometric variables measured.

A correlation was derived among effective base lengths, dental crowding and nasolabial angle using the above derived statistical data.

Sample Selection

The inclusion criteria for study was untreated subjects with complete bilateral Class I and complete bilateral Class II malocclusion (molar relation), Presence of all permanent teeth mesial to first molars and absence of proximal decay and restorations. Exclusion criteria included deciduous or mixed dentition subjects, Subjects with unilateral Class I and Cass II malocclusion, Subjects with dental anomalies of number, size, form and position, and Subjects with any systemic disease. 28 Class I subjects were selected which were further divided into two groups depending upon the severity of the mandibular crowding, upto 3mm (12 subjects) and > 3mm (16 subjects). 32 Class II subjects were selected which were further divided into two groups depending upon the severity of the mandibular crowding, upto 3 mm (12 subjects) and > 3mm (20).

Statistical Analysis

Standard statistical methods were applied to the derived data to obtain the results. The cephalometric variables were compared between the groups with t-tests. Correlation between maxillary and mandibular lengths and dental crowding severity was investigated with the Pearson correlation coefficient. (*P=.05).*

Results and Discussion

The study was conducted with the objective of assessing skeletal, dental and soft tissue parameters in untreated class I and II malocclusion patients. In this study we found an inverse correlation between the effective base lengths and dental crowding and also a statistically significant positive correlation between maxillary and mandibular effective lengths. The mean maxillary and mandibular effective lengths were found out to be 94.5 and 114.5 respectively in Class I malocclusion (Table 2) and 93.82 and 112.54 respectively in class II malocclusion (table 3).

Table 2 : Class I subjects

	N	MEAN	SD	MINIMUM	MAXIMUM
CO – A	28	94.5	8.55	86	103
CO – GN	28	114.5	9.75	104	125
NLA	28	101.33	13.67	75	123

Table 3 : Class II subjects

	N	MEAN	SD	MINIMUM	MAXIMUM
CO – A	32	93.82	8.77	86	102
CO – GN	32	112.54	9.96	101	123
NLA	32	99.5	12.45	72	120

These values were in concordance with Janson et al.[1] Shorter maxillary and mandibular lengths have been reported in patients with incisor crowding. Carter[23] also observed small mandibular lengths in class II malocclusion patients in comparison to class I and normal occlusion subjects. Berg R[24] also found significantly smaller mandibular length in patients with dental crowding. The dominant skeletal pattern observed in our study subjects was more mandibular retrusion and less maxillary protrusion in class II malocclusion.However, in contrast to our findings and available literature, Rosenblum[26] found dominant skeletal pattern to be maxillary protrusion with a normal mandible in class II malocclusion.

Leighton and Hunter[28] also reported smaller found mandibular length in crowded cases with the mean value 57.9 in moderately crowded, 58.1 in severely crowded group and 61.83 in spaced group. In orthodontic diagnosis and treatment planning, Naso Labial Angle (NLA) is one of the soft tissue cephalometric parameters routinely analyzed. In 1997 Fitzgerald et al[31] reported on the evaluation of the nasolabial angle and the relative inclinations of the nose and upper lip. The NLA ranges from 90-120 according to Graber.[32] Legan and

Burstone[33] reports a value of 102 ± 8. According to Arnett,[35] It can range from 103.5 ± 6.8 in Females and 106.4 ± 7.7 in Males.

The value was found to be 100.66±12.853 in males and 101.78±13.122 in females in study conducted by Suja Ani G. and Babu E.C.[36] however this difference was statistically not significant. In our study the average value was found to be 101.3 in Class I and 99.5 in Class II subjects which was not statisitically significant when correlated with other parameters.The NLA measurement changes when an attempt is made to modify the upper dental area with orthodontic treatment procedures.[36-38] Based on this context, this study on correlation between nasolabial angle and effective maxillary and mandibular lengths in untreated class II patients was attempted.

Table 3: correlations between apical base length and dental crowding (Pearson Correlations)

	Pearson's correlation – r	*P* value
Mandibular crowding x Co-A	-.390	0.001
Mandibular crowding x Co-Gn	-.358	0.004
Maxillary crowding x Co-A	-.590	<0.001
Maxillary crowding x Co-Gn	-.372	0.002
Maxillary crowding x Mandibular crowding	0.654	<.001
Co – A x Co – Gn	0.702	<.001
Nasolabial angle x Maxillary crowding	0.030	.970
Nasolabial angle x Mandibular crowding	-0.095	.390

Conclusion

The results of our study suggests that besides tooth size and transverse arch dimensions, effective apical base length is also an important factor related to the amount of dental crowding. Subjects with complete Class I and Class II malocclusion and moderate to severe mandibular crowding have significantly smaller effective apical base lengths than subjects with the same malocclusion and slight mandibular crowding. There is a statistically significant inverse correlation between maxillary and mandibular apical base lengths and the severity of dental crowding. A positive Correlation between Nasolabial angle,

dental crowding and apical base lengths was observed, which was statistically not significant.

Authors' Contributions

All authors read and approved the final manuscript.

Ethical Approval

The Study plan was submitted to the Research and Ethics board of the institute for evaluation, and clearance was granted to carry out this non-invasive study.

References

1. Janson G, Goizueta OE, Garib DG, Janson M. Relationship between maxillary and mandibular base lengths and dental crowding in patients with complete Class II malocclusions. Angle Orthod 2011; 81(2):217-21.
2. Bernabe´ E, Flores-Mir C. Dental morphology and crowding. A multivariate approach. Angle Orthod. 2006; 76:20–25.
3. Doris JM, Bernard BW, Kuftinec MM, Stom D. A biometric study of tooth size and dental crowding. Am J Orthod. 1981; 79:326–336.
4. Miethke RR, Behm-Menthel A. Correlations between lower incisor crowding and lower incisor position and lateral craniofacial morphology. Am J Orthod Dentofacial Orthop. 1988; 94:231–239.
5. Puri N, Pradhan KL, Chandna A, Sehgal V, Gupta R. Biometric study of tooth size in normal, crowded, and spaced permanent dentitions. Am J Orthod Dentofacial Orthop. 2007; 132:279.e277-214.
6. Radnzic D. Dental crowding and its relationship to mesiodistal crown diameters and arch dimensions. Am J Orthod Dentofacial Orthop. 1988; 94:50–56.
7. Richardson ME. The etiology of late lower arch crowding alternative to mesially directed forces: a review. Am J Orthod Dentofacial Orthop. 1994; 105:592–597.
8. Richardson ME. A review of changes in lower arch alignment from seven to fifty years. Semin Orthod. 1999; 5:151–159.
9. Sampson WJ, Richards LC. Prediction of mandibular incisor and canine crowding changes in the mixed dentition. Am J Orthod. 1985; 88:47–63.
10. Howe RP, McNamara JA Jr, O'Connor KA. An examination of dental crowding and its relationship to tooth size and arch dimension. Am J Orthod. 1983; 83:363–373.
11. Bishara SE, Jakobsen JR, Treder JE, Stasi MJ. Changes in the maxillary and mandibular tooth size-arch length relationship from early adolescence to early adulthood. A longitudinal study. Am J Orthod Dentofacial Orthop. 1989; 95:46–59.
12. Mills LF. Arch width, arch length and tooth size in young males. Angle Orthod.1964; 34:124–129.
13. Fastlicht J. Crowding of mandibular incisors. Am J Orthod. 1970; 58:156–163.
14. Peck S, Peck H. Crown dimensions and mandibular incisor alignment. Angle Orthod. 1972; 42:148–153.

15. Baccetti T, Franchi L, McNamara JA Jr, Tollaro I. Early dentofacial features of Class II malocclusion: a longitudinal study from the deciduous through the mixed dentition. Am J Orthod Dentofacial Orthop. 1997; 111:502–509.
16. Nance HN. The limitations of orthodontic treatment; diagnosis and treatment in the permanent dentition. Am J Orthod. 1947; 43:36–84.
17. Sayin MO, Turkkahraman H. Factors contributing to mandibular anterior crowding in the early mixed dentition. Angle Orthod 2004; 74(6):754-8.
18. Karlsen A, Krogstad O. Morphology and growth in convex profile facial patterns: A longitudinal study. The Angle Orthodontist 1999; 69(4):334-44.
19. Braun S, Hnat WP, Fender DE, Legan HL. The form of the human dental arch. The Angle Orthodontist 1998; 68(1):29-36.
20. Baccetti T, Stahl F, McNamara JA, Jr. Dentofacial growth changes in subjects with untreated Class II malocclusion from late puberty through young adulthood. Am J Orthod Dentofacial Orthop 2009; 135(2):148-54.
21. Carter NE. Dentofacial changes in untreated Class II division 1 subjects. Br J Orthod 1987; 14(4):225-34.
22. Turkkahraman H, Sayin MO. Relationship between mandibular anterior crowding and lateral dentofacial morphology in the early mixed dentition. Angle Orthod. 2004; 74:759–764
23. Sayin MO, Turkkahraman H. Cephalometric evaluation of nongrowing females with skeletal and dental Class II, division 1 malocclusion. Angle Orthod 2005; 75(4):656-60.
24. Berg R. Crowding of the dental arches: a longitudinal study of the age period between 6 and 12 years. Eur J Orthod 1986; 8(1):43-9.
25. Fushima K, Kitamura Y, Mita H, et al. Significance of the cant of the posterior occlusal plane in class II division 1 malocclusions. Eur J Orthod 1996; 18(1):27-40.
26. Rosenblum RE. Class II malocclusion: mandibular retrusion or maxillary protrusion? Angle Orthod 1995; 65(1):49-62.
27. Karlsen AT. Craniofacial morphology in children with Angle Class II-1 malocclusion with and without deepbite. Angle Orthod 1994; 64(6):437-46.
28. Leighton BC, Hunter WS. Relationship between lower arch spacing/crowding and facial height and depth. Am J Orthod1982; 82(5):418-25.
29. Ricketts. 1957. Establishing the lip to nose relationship. The Angle Orthodontist, 27:14-21.
30. Satravahas et al. The significance of the integumentary profile. American Journal of Orthodontics and Dentofacial Orthopedics.1987; 92:422-426
31. Fitzgerald JP, Nanda RS, Currier GF. An evaluation of the nasolabial angle and the relative inclinations of the nose and upper lip. American Journal of Orthodontics and Dentofacial Orthopedics.1992; 102:328–334
32. Thomas M.Graber. Robert L. Vanarsdall, Jr. Katherine W.L. Vig. Orthodontics: current principles and techniques. 4 ed. Missouri: Elsevier; 2005; 36.
33. Legan H, Burstone CJ. Soft tissue cephalometric analysis for orthognathic surgery. Oral Surg.1980; 38:744-51.
34. Athanasios E Athanasiou. Orthodontic Cephalometry. London: Mosby-Wolfe; 1995; 267-268.

35. G.William Arnett.et al. Soft tissue cephalometric analysis: Diagnosis and treatment planning of dentofacial deformity.Am J Orthod Dentofacial Orthop 1999; 116:239-53.
36. Suja Ani G, Babu E.C. Correlation between Naso Labial Angle and Effective Maxillary and Mandibular lengths in untreated Class II Patients. International Journal of Interdisciplinary and Multidisciplinary Studies, 2014; 1(3):9-14.
37. Baccetti T, Franchi L, McNamara JA, Jr., Tollaro I. Early dentofacial features of Class II malocclusion: a longitudinal study from the deciduous through the mixed dentition. Am J Orthod Dentofacial Orthop 1997; 111(5):502-9.
38. Lundstrom A. A study of the correlation between mandibular growth direction and changes in incisor inclination, overjet, overbite and crowding. Trans Eur Orthod Soc 1975; 131-40.