ORIGINAL RESEARCH

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The Relationship Between Maxillary and Mandibular Base Lengths and Dental Crowding in Patients with True Class II Malocclusions

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ABSTRACT

INTRODUCTION: Orthodontists, for a long time have considered that occlusion and facial beauty are so interdependent that they must be equal goals of treatment.

AIM: To validate the relationship between maxillary and mandibular effective lengths and dental crowding in patients with Class II malocclusions.

MATERIALS AND METHOD: A sample of 40 orthodontic patients with complete bilateral Class II malocclusions in the permanent dentition (25 males, 15 females) who were divided into two groups based on severity of pre-treatment mandibular anterior dental crowding. The maxillary and mandibular effective lengths and tooth-arch size discrepancies were measured on the pre-treatment Lateral cephalograms and initial casts, respectively. Intergroup comparisons of apical base lengths were assessed with independent t-tests. Correlation between effective length and dental crowding was assessed by Pearson's correlation coefficient ($P < .05$).

RESULTS: Subjects with Class II malocclusion and moderate to severe crowding had significantly smaller maxillary and mandibular effective lengths compared with subjects without crowding and with minimal dental crowding. A weak inverse correlation was also found between maxillary and mandibular effective lengths and the severity of dental crowding.

CONCLUSION: In patients with complete Class II malocclusion, decreased maxillary and mandibular effective lengths constitute a significant factor associated with dental crowding.

KEYWORDS: Malocclusion, Crowding, Maxilla, Mandible

INTRODUCTION

The prime objective of orthodontic treatment is to obtain better functional stability and aesthetics as well as good facial balance and harmony in an individual. It is possible through orthodontic intervention to achieve a better jaw relationship and a favourable relationship of the teeth to each other in the same and opposing arches and to their supporting bone and soft tissue. The occlusion and facial beauty are very much interdependent.

Anterior crowding is one of the most common problems that motivate patients to seek orthodontic treatment. Dental crowding can be defined as a "discrepancy between tooth size and arch size that result in malposition and rotation of teeth". Till date, many factors have been evaluated and found to be related to anterior dental crowding including dental arch width, arch length and mesiodistal tooth diameter.

Studies show that smaller mandibular body lengths have been shown to be significantly associated with crowding in permanent dentition.[1-3] Hence, it can be put across that patients with class II malocclusion have a smaller mandibular length than subjects with normal occlusion and class I malocclusion.

Another feature is the shape of facial profile which depends between the relationship between prognathism of the jaws. Facial profiling can also be done through dental pictures can also be analysed by comparing measurements on the tracing on the lateral skull- radiographs with known standards.[4,5]

To study the facial form and position of denture, it has been documented that upper and lower incisors to the APo plane is very useful guideline for determining cephalometric crowding of the anterior teeth, especially lower anteriors. This relation of the lower incisors to the APo plane is a key to communication of the problems with the anterior teeth.[6]

Although various researchers have tried to assess the relationship between facial profile and crowding, the

relationship between apical base length and dental crowding among patients in class II malocclusion has not been investigated exclusively. Therefore, the objective of this study was to evaluate the relationship of maxillary and mandibular effective length to the amount of anterior dental crowding in patients with complete class II malocclusion.

MATERIALS AND METHODS

This cross-sectional study was carried out on subjects with class II malocclusion with the samples being retrospectively selected from the files of Orthodontic department of Dr. R. Ahmed Dental College and Hospital, Kolkata. Following an Ethical Approval, forty patients (25 males and 15 females) who satisfied the inclusion criteria were selected through convenience sampling.

The inclusion criteria included presence of complete (full cusp) bilateral class II malocclusion (molar relationship), No open bite or cross bite, presence of all permanent teeth up to the first molar, absence of proximal decay or restoration, and absence of dental anomalies of number, size, form and position. The sample was be divided into two groups based on severity of pre-treatment mandibular anterior dental crowding. Group A consisted of 15 patients (10 males and 5 females) with a mean age of 12.81years and crowding >3mm and Group B had 25 patients (15 males and 10 females) with a mean age range 12.80 years and crowding < 3mm.

Measurements were performed on pre-treatment dental casts and lateral head films. Tooth size and arch length discrepancy in the maxilla and mandible was calculated as the difference between arch perimeter and space required. Arch perimeter was measured on dental casts from the mesial aspect of first permanent molar to its antimere in millimetres with a brass wire. In a well aligned arch, arch perimeter were equal to the sum of tooth widths. Negative values indicated crowding. The space required was calculated by measuring mesio-distal width of each tooth from second premolar to contralateral second premolar in millimetres by a single examiner.

Maxillary and mandibular effective lengths were measured on initial cephalogram. Mandibular effective length were measured from Co-Gn(Co- the most posterior superior point on the head of the condyle and Gn- is the most anterior inferior point on the symphysis of chin.) and the maxillary effective length were measured from Co-point- A(Co-the most posterior superior point on the head of the condyle and pointA-deepest point in the midline between the anterior nasal spine and alveolar creast between the two incisors) then the Maxillomandibular differential is obtained by effective mandibular length-effective maxillary length. Inter group comparisons of apical base lengths were performed with independent t-tests. Correlation between base length and dental crowding was examined by means of Pearson's correlation ($p<.05$) using SPSS version 16.0.

RESULTS

The mean age of patients in group 1 was 12.81 years (SD = 0.65) with range 12.0-14.0 years while mean age of patients in group 2 was 12.80 (SD = 0.76) with range 12.0- 14.0 years. The difference of mean age in two groups was statistically significant and the groups were compatible in terms of sex distribution. (Table 1).

Gp.	Number	Mean	SD	t-test	p-value
1	15	12.81	0.65	11.8044	<0.0001
2	25	12.80	0.76		

Table 1. Age Distribution of the patients (Gp.: Group)

According to the selection criteria, there were significant intergroup differences in maxillary and mandibular crowding with maxillary and mandibular effective lengths not being statistically significant (Table 2).

Significant weak to moderate inverse correlations were observed between the apical base effective lengths in comparison to the maxillary and mandibular crowding, while moderate to strong positive correlations between maxillary and mandibular crowding and between maxillary and mandibular effective lengths were observed (Table 3).

DISCUSSION

Various studies have been carried out in the past to identify the etiological and contributing factors of dental crowding, however it is still an ongoing subject of debate.[7-14] Although, it was established that dental crowding can be the result of changes in human evolutionary trends[15] as well as certain hereditary and environmental factors[16], the importance of investigating the various clinical characteristics that contribute to it should be emphasized during the

Group	Number	Mean	SD	Minimum	Maximum	Median	t-statistic	p-value
MAXILLARY CROWDING								
1	15	8.7133	3.5952	4.0000	14.0000	8.0000	3.5469	0.06
2	25	4.4400	3.7425	2.0000	16.5000	3.0000		
MANDIBULAR CROWDING								
1	15	7.9000	2.3845	3.5000	11.0000	8.0000	11.8044	0.07
2	25	2.2680	.2495	2.0000	2.5000	2.5000		

Table 2. Differences in Maxillary and Mandibular Crowding with Maxillary and Mandibular Effective Lengths among Patients

	r	p-value	Remarks
Mandibular crowding X Co-A	-0.39	0.012	Significant
Mandibular crowding X Co-Gn	0.10	0.527	Not Significant
Mandibular crowding X Maxillary crowding	0.49	0.001	Significant
Maxillary crowding X Co-A	1.00	< 0.001	Significant
Maxillary crowding X Co-Gn	0.10	0.527	Not Significant
Co-Gn X Co-A	0.33	0.236	Not Significant

Table 3. Differences in Maxillary And Mandibular Crowding with Maxillary and Mandibular Effective Lengths among Patients

overall orthodontic treatment planning. The present study was an attempt to evaluate the relationship between maxillary and mandibular base lengths and crowding in patients with complete class II malocclusion. The different parameters analysed on lateral cephalometric x-ray tracing. These are discussed below:-

1. Maxillary effective length (Co-A): The linear measurement of this is an assessment of favourable and unfavourable growth of maxilla in relation to crowding. Midfacial length is measured from condylion to point A. It must be stressed that the effective lengths of the midface are not sex or gender dependent but are related only to the size of the component parts. Thus the term " small, " " medium, " or " large " are used. Selection of group in the present study was done according to the severity of mandibular dental crowding by using 3 mm crowding as the basis in which patients were assigned groups, as also stated by Doris et al.[17] and Puri et al.[18] Hence, Group A consisted of patients with patients with moderate to severe crowding whereas Group B consisted of patients without crowding or with slight crowding. While evaluating effective maxillary lengths Janson et al.[19] found that the mean value of 81.82 mm and SD of 4.52 mm in Group A and mean value of 86.14 mm and SD of 5.27mm in Group B. Khoja et al.[20] found the mean value of 94 mm and SD of 7.52 in Group A and mean value of 96 mm and SD of 6.62 mm in Group B respectively.

Berg (1986)[21] compared a group of subjects with normal occlusion and a group of patients with dental crowding of at least 3.5 mm in the permanent dentition and reported that dental crowding showed a significantly smaller mandibular length compared to patients with normal occlusion.

In the present study, the mean value of 84 mm and SD of 8.42 in group A and mean value of 91mm and SD of 5.42 mm in group B. The present study demonstrates clearly and very positively that the mean value and SD of Group A subjects with complete class II malocclusion resembles very closely the finding of Janson et al. (2011)[19] and Khoja et al (2014).[20]

Based on the result of present study it can be speculated that midface effective lengths would correlate to given range of mandibular dental crowding. Therefore, effective lengths of the maxillary apical bases can be inversely associated to the amount of dental crowding.

2. Mandibular effective length (Co-Gn): The mandibular effective length is measured from Condylion to Gnathion. The group under investigation includes only patients with complete bilateral class II

molar relationship so that class II malocclusions could be clearly characterised. Janson et al.[19] while evaluating effective mandibular base length found that the mean value of 103 mm and SD of 5.01 mm in Group A. and mean value of 108 mm and SD of 6.04 mm in Group B. Khoja et al.[20] found that the mean value of 97.8 mm and SD of 4.82 mm in Group A and mean value of 101 mm and SD of 5.42 mm in Group B. In the present study the mean value is 108.2 mm and SD of 22 mm in Group A and mean value of 111.6 mm and SD of 5.44 mm in group B.

The present study demonstrates clearly and very positively that the mean value and SD of Group A subjects with complete class II malocclusion resembles very closely the finding of Janson et al.[19] (2011) and Khoja et al. (2014).[20]

According to the study conducted by Ani GS et al.,(2014)[22] it was found that the ach perimeter assessed with a brass wire had greater accuracy as compared to using vernier caliper.

It was observed that patients with moderate to severe dental crowding had smaller mandibular effective lengths compared with subjects without crowding and with minimum dental crowding. In addition there was a significant weak to moderate inverse correlation between the amount of crowding and the mandibular effective lengths. Based on the result of present study, we speculate that mandibular effective lengths would correlate to given range of mandibular dental crowding and hence, effective lengths of the mandibular apical bases can be inversely associated to the amount of dental crowding.

CONCLUSION

In the present study, groups selected according to mandibular crowding, maxillary crowding was also observed significantly in the severely crowded group and hence we conclude that severely crowded cases are more likely to present shorter effective apical base lengths and that the shorter the base lengths, greater is the likehood for crowding. These findings are specially applicable to subjects having complete class II malocclusion.

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Cite this article as:
Palkit T, Aggarwal I, Malhotra Y, Goyal M, Uppal M, Singh N. The Relationship Between Maxillary and Mandibular Base Lengths and Dental Crowding in Patients with True Class II Malocclusions. Int Healthc Res J. 2020;4(7):OR5-OR9. https://doi.org/10.26440/IHRJ/0407.10280

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Source of support: Nil, **Conflict of interest:** None declared

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