Comparative Assessment between Maxillary and Mandibular Apical base Length with Severity of Dental Crowding and Spacing in Class II Malocclusion Cases in South-Western Maharashtrian Population

Salman Shaikh[1], Sunil Kumar Pulluri[2], Shrinivas Ambarkar[3], Akash Lavate[4], Sneha Hoshing[5], Deval Choukhe[6]

ABSTRACT

Introduction: Anterior crowding is one of the most prevalent malocclusion amongst the general population, therefore, encountered by Orthodontists on a regular and frequent basis. Crowding and spacing are often related to arch dimensions as well as incisor inclination and plethora of often unidentified underlying factors. In class II malocclusion, smaller mandibular length than subjects with normal occlusion and class I malocclusion is seen. However, the relationship between apical base length and anterior dental crowding in an exclusive sample of class II malocclusion has not been investigated enough. Aim and objectives - The purpose of this investigation was to (1) Compare the maxillary and mandibular apical base length in class II malocclusion cases; (2) To assess the apical base length in moderate to severe mandibular crowding or spacing.

Material and Methods: Pre-treatment Orthodontic casts of 50 patients were collected and divided into four groups according to class II malocclusion with spacing or crowding. The following parameters were measured and used to compare the groups: individual and collective mesiodistal tooth diameters, dental arch length were used. Study cast values were measured and statistically analysed.

Result Subjects with complete class II malocclusion and moderate to severe mandibular crowding [≥3mm] have statistically significant smaller apical base lengths as compared to the subjects with slight crowding or spacing [<3mm] with mean value 0.0001.

Conclusions: There exists an inverse correlation between maxillary and mandibular apical base lengths and the severity of dental crowding and direct correlation with spacing.

Keywords: Apical Base Lengths, Class II Malocclusion, Crowding, Incisor Inclination, Spacing.

INTRODUCTION

Mandibular anterior crowding has been the primary cause for patients to seek an Orthodontist and has ever motivated patients to move ahead towards achieving an ideal smile as it is one of the most frequent types of malocclusion prevalent worldwide. Mandibular anterior crowding refers to the discrepancy between mesiodistal tooth widths of four permanent incisors and the available space in the alveolar process. However, incisor crowding is not merely a tooth-arch size discrepancy but a discrepancy among many variables. Multitude of factors come into play to affect the development and severity of crowding, such as direction of mandibular growth, early loss of deciduous molars, mesiodistal tooth width, arch dimensions, the oral and perioral musculature, and incisor and molar inclination.[1]

Discrepancy between tooth size and arch size that results in malposition and/or rotation of teeth. The association between dental crowding and tooth size has been studied by various researchers, however discrepancies exist between the conclusions derived. It is hypothesized that tooth size is not the only determining factor in the origin of dental crowding. Certain authors have suggested that lower anterior crowding is strongly associated with eruption of lower third molars. In an investigation performed by Howe *et al.*, comparisons made between crowded and non-crowded groups using study models indicated that arch dimensions made a greater contribution to dental crowding than tooth size. Other investigators found the same correlation between arch dimensions and dental crowding.[2,3]

In general, normal occlusion and Class I malocclusion do not have smaller mandibular apical base length than subjects with Class II malocclusion. However, the relationship between apical base length and anterior dental crowding in a sample with Class II malocclusion needs to be studied exclusively and has not been investigated.[4] Therefore, the objective of this study was to evaluate the relationship of maxillary and mandibular effective lengths to the amount of anterior dental crowding in patients with complete Class II malocclusion. The hypothesis tested was that patients with complete Class

[1]PG Student, Department of Orthodontics and Dentofacial Orthopaedics, PDU Dental College Solapur, [2]Professor and HOD Department of Orthodontics and Dentofacial Orthopaedics, PDU Dental College, Solapur, [3]Professor Department of Orthodontics and Dentofacial Orthopaedics, PDU Dental College Solapur, [4]Reader Department of Orthodontics and Dentofacial Orthopaedics, PDU Dental College Solapur, [5]Reader Department of Orthodontics and Dentofacial Orthopaedics, PDU Dental College Solapur, [6]PG Student, Department of Orthodontics and Dentofacial Orthopaedics, PDU Dental College Solapur, India

Corresponding author: Dr. Salman Shaikh, 44, Sukoon Villa, Mohite Nagar, Hotgi Road Solapur-413003, India

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II malocclusions and mandibular crowding of 3 mm have similar apical base effective lengths as patients with the same malocclusion and mandibular crowding, 3 mm.

MATERIAL AND METHODS

The present study was conducted in the department of Orthodontics and Dentofacial Orthopaedics at Pandit Deendayal Upadhyay Dental College and Hospital, Solapur, India. The sample was retrospectively selected from the orthodontic department of Pandit Deendayal Upadhyay Dental College and Hospital, Solapur.

The inclusion criteria were as follows:

1. Presence of a complete (full cusp) bilateral class II malocclusion molar relationship
2. Presence of all permanent teeth up to the first molars

The exclusion criteria were as follows:

1. No open bite or cross bite
2. Absence of proximal decay or restoration
3. Absence of dental anomalies of number, size, form and position
4. Absence of any disease or syndrome with dental manifestations
5. Absence of clefts of lip or palate

Study design

50 patients who satisfied the inclusion criteria were selected. The sample was then divided into four groups according to the severity of pre-treatment dental crowding/ spacing present in the mandibular arch.

Group 1 - 24 patients with crowding < 3mm.
Group 2 - 12 patients with crowding ≥ 3mm.
Group 3 - 6 patients with spacing < 3mm.
Group 4 - 8 patients with spacing ≥ 3mm.

Recording of measurements

Mandibular and maxillary crowding/spacing were calculated as the difference between arch perimeter and the sum of tooth widths from second premolar to second premolar on the other side as shown in Fig 3.

The values were calculated in milli meters by single examiner. The arch perimeter was equal to the sum of tooth width in a well aligned arch. Negative values indicated crowding, whereas values with arch perimeter being greater than the sum of tooth widths indicated spacing.

A set of maxillary and mandibular dental casts from each patient were taken as shown in Fig 1. A Vernier calliper calibrated with digital micrometer was used to measure the mesio-distal widths of individual teeth. In addition, the arch perimeter for maxillary and mandibular dental arches was measured using a brass wire and a set of maxillary and mandibular pre-treatment dental casts as showed in Fig 2.

STATISTICAL ANALYSES

Intergroup compatibility for initial age and sex distribution was evaluated with t-tests and chi-square tests respectively. Correlation between the maxillary and mandibular effective lengths and dental crowding and spacing severity was investigated with the Pearson correlation coefficient. Significance level was fixed at $p < 0.0001$

-Errors in the study

A month after the first measurements were taken, 50 pairs of dental casts (20 cast randomly) were taken and re-measured.

RESULTS

Subjects with moderate to severe dental crowding (≥3mm) showed smaller maxillary and mandibular apical base lengths (81.80 mm and 102 mm respectively) as compared to those with mild (<3mm) or no dental crowding (Table 1).

In groups with dental spacing, it was seen that the subjects with moderate to severe (≥3mm) dental spacing have larger maxillary and mandibular apical base lengths (95.53 mm and 110.89 mm respectively), as compared to those with slightly (<3mm) spaced dentition i.e. 91.50 mm for

			N	Mean	SD	Mean difference	t-value	p-value
Spacing								
TTM	U	< 3 mm	5	73.0	4.3	2.5	1.61	0.14
		> 3 mm	8	70.5	1.07			
	L	< 3 mm	5	63.4	5.6	2.72	1.09	0.29
		> 3 mm	8	66.1	3.4			
AL	U	< 3 mm	5	71.2	6.5	2.8	1.2	0.25
		> 3 mm	8	74.0	1.2			
	L	< 3 mm	5	62.8	5.8	7.95	3.12	0.009
		> 3 mm	8	70.7	3.4			
Crowding								
TTM	U	< 3 mm	12	76.7	4.7	0.08	0.05	0.9
		> 3 mm	24	76.8	4.4			
	L	< 3 mm	12	68.0	2.2	1.25	1.09	0.3
		> 3 mm	24	69.2	3.6			
AL	U	< 3 mm	12	74.9	4.3	2.7	1.34	0.19
		> 3 mm	24	72.2	6.4			
	L	< 3 mm	12	65.7	2.4	5.6	4.3	0.0001
		> 3mm	24	60.1	4.1			

Table-1: Subjects with moderate to severe dental crowding (≥3mm) had smaller maxillary and mandibular base length compared to those with mild (<3mm) or no dental crowding.

maxillary and 110.41 mm for mandibular base lengths. A positive correlation factor of 0.266 and 0.324 were observed between mandibular spacing and maxillary and mandibular base lengths respectively.

Figure-1: A set of maxillary and mandibular dental casts

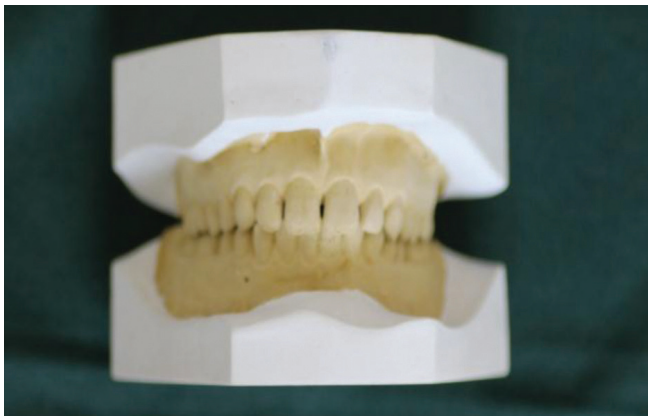

Figure-2: Pre-treatment dental casts

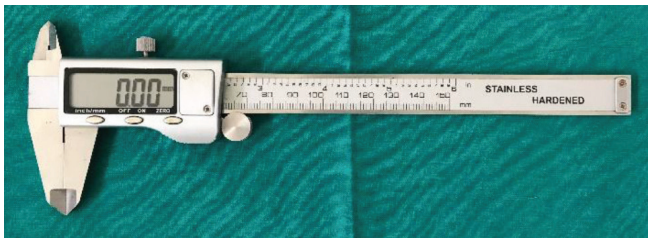

Figure-3: Vernier calliper calibrated with digital micrometer

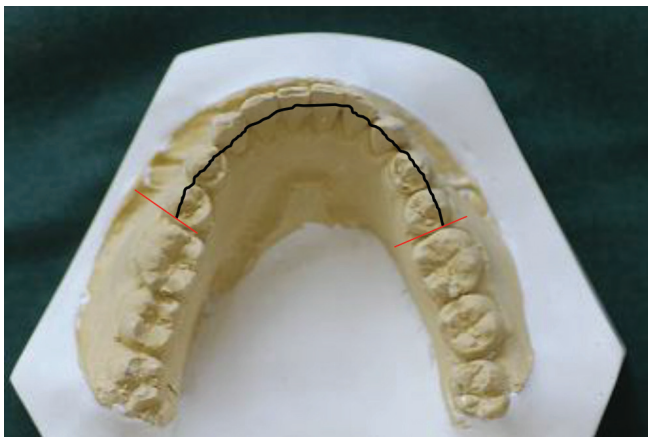

Figure-4: Sum of tooth widths from second premolar to second premolar on the other side.

DISCUSSION

Orthodontic diagnosis being the ultimate priority in delivering top notch, stable results relies not only upon anatomic relations, physiologic and biologic factors, but also upon aesthetic judgement of the Orthodontist. Therefore, Orthodontic diagnosis cannot be visualized as an exact and nonmodifiable science and predicating it upon such constant variables would be equivalent to casting all individuals in a common mould, thus being highly inaccurate.[2]

An assessment of the amount of crowding or spacing is one of the primary steps in orthodontic diagnosis and treatment planning. Objective information regarding the amount of arch length-tooth-size discrepancy in the incisor region often predominates the balance for or against premolar extraction. A weak to moderate inverse correlation was found between the amount of dental crowding and maxillary and mandibular apical base lengths. Strong positive correlations were found between spacing and maxillary and mandibular apical base lengths respectively. These results are similar to the results seen in a previous study conducted by Janson *et al.* Similar results were

also seen in some previous studies, where the malocclusion was not specified.

The groups investigated included only patients with complete bilateral Class II molar relationship so that Class II malocclusions could be clearly characterized. Group selection according to the severity of mandibular dental crowding used 3-mm crowding as a limit for group assignment as previously described.[5] In this way, group 1 consisted of patients with moderate to severe crowding whereas group 2 had patients without crowding or with slight crowding. Only three patients in group 2 had spacing in the mandibular dental arch, with a maximum of 3 mm of positive discrepancy. Some previous studies used 4-mm crowding as the splitting limit; however, this criteria could have further reduced the number of patients in group 1,2,3,5. Experimental groups with large numbers of individuals are difficult to find when the selection criteria are highly specific. As stated by Richardson, Adams, and McCartney, the discrepancies in measuring an apparently simple entity, such as the width of a tooth, may be surprisingly large. In their study they found that a single operator could reproduce his measurements with an acceptable degree of accuracy, whereas the discrepancies between measurements made by different operators were larger.[5]

The results showed that subjects with moderate to severe dental crowding had smaller maxillary and mandibular effective apical base lengths compared with subjects without crowding or with slight dental crowding (Table 1). In addition, there was a significant weak to moderate inverse correlation between the amount of crowding and maxillary and mandibular effective lengths.

Peck and Peck[6,7] reported that differences observed between arches with and without incisal irregularity (Little's index)

could be the cause not only for larger MD tooth dimensions but also for shorter BL tooth dimensions (which would indicate a general morphological deviation). However, Smith et al[8] suggested later that the differences were because of method of calculation of the Peck ratio, which includes MD tooth size measurements, which are associated with crowding. Our opinion is that it has to be more than just MD tooth sizes because, according to the present results, the canine crown proportion exhibits differences in both dental arches, whereas their respective MD tooth sizes did not result in statistical differences in the lower arch.[9]

CONCLUSION

The results of the present study reveal that the subjects with complete class II malocclusion and moderate to severe mandibular crowding have significantly smaller base lengths as compared to the subjects with same malocclusion with slight crowding or spacing.

Strong positive correlations were found between degree of crowding and spacing and maxillary and mandibular apical base lengths respectively. Subjects with complete class II malocclusion and moderate to severe mandibular spacing have significantly larger apical base lengths as compared to the subjects with same malocclusion with slight spacing or crowding.

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