Research Article

A COMPARATIVE EVALUATION OF TRANSVERSE, VERTICAL AND SAGITTAL ARCH DIMENSIONS IN CLASS I AND CLASS II DIVISION 1 MALOCCLUSION SUBJECTS IN KARNATAKA POPULATION

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ABSTRACT

Objectives: To determine and compare the palatal dimensions in transverse, vertical and sagittalplanes of space in class I and class II division 1 malocclusion subjects in Karnataka population.

Material and Methods: The study consisted of 110 study models out of which 55 samples belonged to class I malocclusion subjects and 55 samples belonged to class II division 1 malocclusion subjects. Samples were obtained from patient records seeking orthodontic treatment from various parts of Karnataka (India) at J.S.S dental College and Hospital, Mysore. A total of 9 parameters were assessed which consisted of measurements of transverse dimensions at inter-canine, 1[st]inter-premolar, 2nd inter-premolar, 1st inter-molar,vertical dimensions at inter-canine, 1st inter-premolar, 2nd inter-premolar, 1st inter-molar, sagittal dimensions from the tip of the incisive papillae bisecting a line passing through the point connecting the buccal grooves of two first molars.

Results: Class I malocclusion subjects showed a considerablygreater value (p<0.48) in the 1st inter-premolar arch width dimensions compared to class II division 1 malocclusion subjects.

Conclusion: Maxillary arch width in the posterior region preferably in the 1[st]inter-premolar region wasfound to be wider in class I malocclusion subjects and narrower in class II division 1 malocclusion subjects.

INTRODUCTION

In context of the arising interest among the clinicians, anthropologists, and human oral biologists(Bhalla*et al*, 2014) a keen interest has always taken place to gather knowledge regarding the maxillary arch dimensions. It is a common phenomenon these days to attain a modified arch form at the end of an orthodontic phase of treatment. These changes or modification among the orthodontic subjects are usually required to affect the stability of the results that has been achieved. This kind of stability of arch form is the least understood however it is considered the most desirable goal to be achieved. Therefore obtaining a functionally stable esthetic arch form is of outmost importance in orthodontics(Patel D *et al*, 2015).

The treatment results of a particular case can be predicted effortlessly provided a clinician has an upper hand in diagnosing the arch length and arch width discrepancies.To deal with a developing malocclusion such information can be helpful in intercepting and finally preventing a malocclusion (Patel D *et al*, 2015)

The estimation of the dental arch parameters is of prime importance in diagnosis and treatment planning because availability of space, esthetics and mostly the stability of the arch form cannot be neglected, as it lays the main foundation for approaching an extraction or a non-extraction treatment protocol.

MATERIAL AND METHODS

The study sample consisted of 110 dental pretreatment casts (55 belonging to Class I malocclusion subjects and 55 belonging to Class II division 1 malocclusion subjects). Class 1 malocclusion subjects consisted 28 female patients and 27 male patients, Class II division 1 malocclusion subjects consisted of 30 female patients and 25 male patients. These patients belonged to a mean age group of 15-25 years. The reasons for selecting patients within these age groups were basically due to the fact that after 14 years of age, arch widths were estimated to be relatively constant.These patients were part of an ongoing orthodontic treatment program at J.S.S Dental College and Hospital, Mysore. These patients belonged to different parts of Karnataka state (India)residing in and around Mysore district. Samples of group 1 consisted of class I molar and canine

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relation bilaterallyand group 2 consisted of class II molar and canine relations bilaterally. Subjects of the study showed class I jaw basis in class I malocclusion and class II jaw basis in class II malocclusion subjects, assessment of which was done based upon the cephalometric data present in the college records. All the samples in the two groups depicted an average growth pattern.

Transverse (width), vertical (depth) and antero-posterior (length) measurement was done using 110 set of models (55 in each group).

For assessment of the hard palate dimensions, the points for reference were marked at the most apical part of the crown situated palatally (tooth and the gingival margin junction) of the maxillary canine, first premolars and second premolars, as for the molars, reference points considered was at the junction of the buccal groove and gingival margin. For measurement of transverse (width) dimensions, distance was measured from the canine reference point of one side to the canine reference point on the opposite side of the arch, same protocol was followed for firstpremolars, second premolars and first molars. For measuring the vertical (depth) dimensions, perpendicular distances from the midpoint were measured from the line joining the two respective reference points in the inter-canine, first inter-premolar, second inter-premolar and the first inter-molar regions. The antero-posterior (sagittal) dimension of the hard palate was measured using a straight line passing from the most anterior pointon the incisive papillae bisecting a line drawn from the buccal groove and gingival junction of the first molar (Figure 1 and 2).

With a resolution of 0.01 mm and ±0.02 precision the measurements were performed using a digital vernier caliper. Internal measuring sides of the caliper were used for measuring transverse and antero-posterior dimensions of the models. A total of 9 parameters were assessed (Figure 1 and 2):

1. Inter-canine distance.
2. Inter-canine depth.
3. 1st Inter-premolar distance.
4. 1st Inter-premolar depth.
5. 2nd Inter-premolar distance.
6. 2nd Inter-premolar depth.
7. 1st Inter-molar distance.
8. 1st Inter-molar depth.
9. Antero-posterior length.

Statistical Analysis

A statistical analysis was done using the SPSS software number 20.0. An independent samples't' test (table 1) was done, a value of $p < .048$ was found to be considerably significant in the first group samples with a mean value of 27.3 (table 2 and graph 1) with respect to the third parameter(1st inter-premolar distance) put forth in the study.

RESULTS

A significant difference ($p < .048$) was observed in the 1st premolar transverse (width) parameter depicting a prevalence of greater distance in class I malocclusion subjects when compared to the class II division 1 malocclusion subjects (table 2 and graph 1).
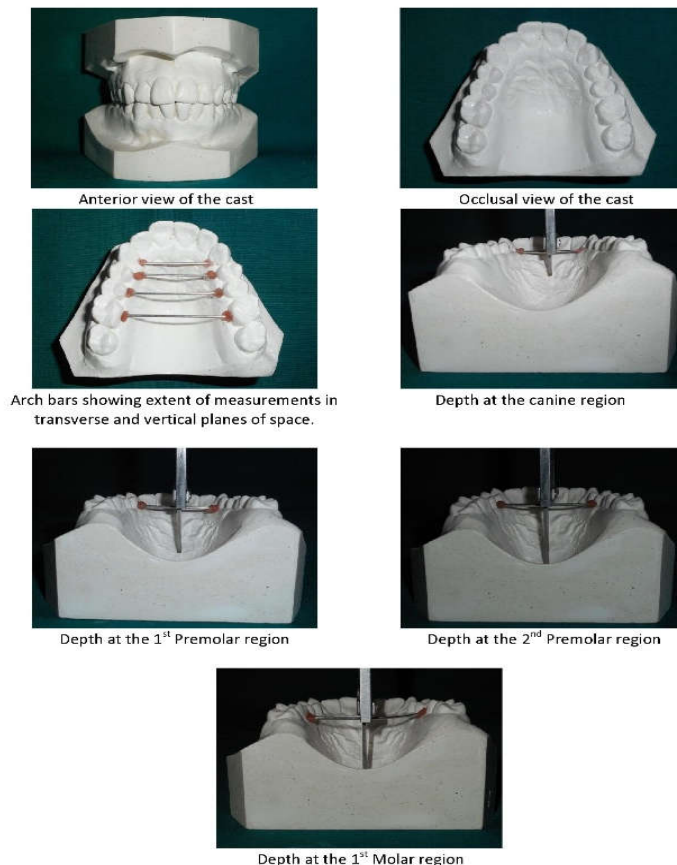

Figure 1 Photographic representation of the study model sample and its measuremental extent in vertical plane of space

Width at the Canine region

Width at the 1st premolar region

Width at the 2nd Premolar region

Width at the 1st Molar region

Antero-posterior measurement from rugae behind the central incisors upto the line bisecting the posterior line passing from the palatal grooves of the molar.
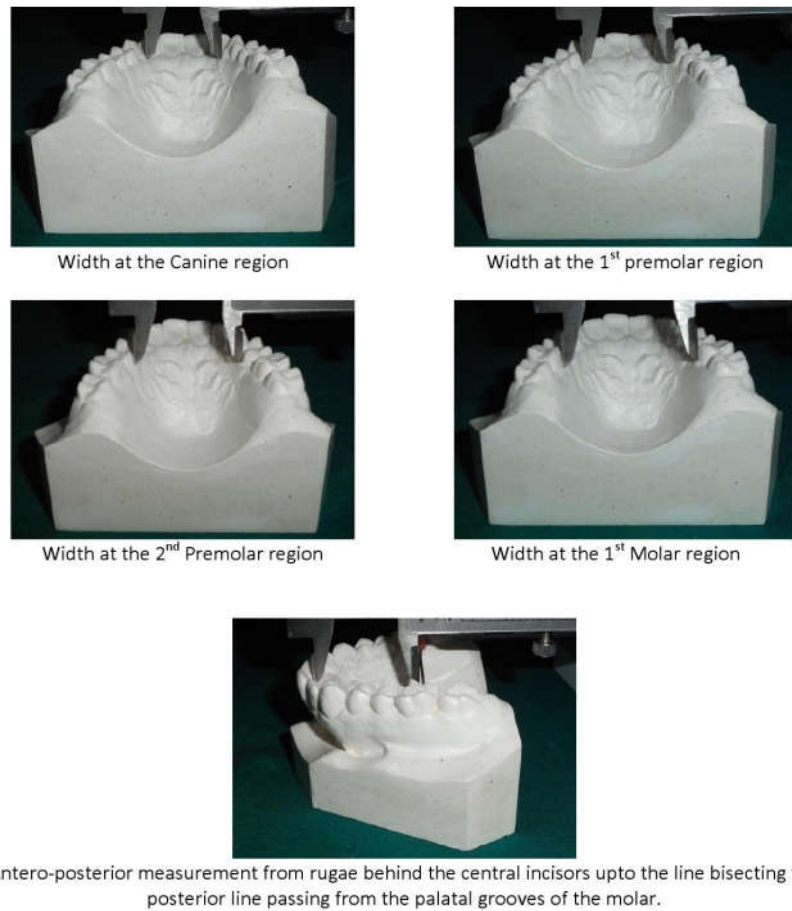
Figure 2 Photographic representation of the measurements made in transverse and sagittal planes of space

Therefore, class I malocclusion subjects possessed a greater transverse (width)dimensionin the first premolar region as compared to the first premolar region in the class II division 1 malocclusion subjects.

Table 1 Independent Samples't' Test

	t-test for Equality of Means			
	t	**Degree of freedom**	**Significance (2-tailed)**	**Mean Difference**
Inter-canine Distance	-.505	108	.615	-.32000
Inter-canine Depth	-1.954	108	.053	-1.32436
1st Inter-premolar Distance	2.003	108	.048	1.16182
1st Inter-premolar Depth	-.267	108	.790	-.11273
2nd Inter-premolar Distance	.729	108	.468	.39455
2nd Inter-premolar Depth	.688	108	.493	.30727
1st Inter-molar Distance	.799	108	.426	.42727
1st Inter-molar Depth	.495	108	.622	.23091
Antero-posterior	-.529	108	.598	-.41818

DISCUSSION

Several studies have contributed to the investigations that were performed in the area of dental arch parameter measurement in specific populations. It is very important from a clinician's point of view to carefully analyze the changes taking place in the dental arch form before planning and executing a treatment plan.***Transverse dimensions:*** Inter-canine widths has been previously studied and there was indeed some differencesobserved.

Table 2 Comparison between two groups using descriptive statistics.

	Group	N	Mean	Std. Deviation	t value	P value
Inter-canine Distance	C I	55	24.9036	3.87054	.505	.615
	C II	55	25.2236	2.66805		
Inter-canine Depth	C I	55	8.8720	2.48674	1.954	.053
	C II	55	10.1964	4.36734		
1stInter-premolar Distance	C I	55	27.4473	2.53858	2.003	**.048**
	C II	55	26.2855	3.47347		
1st Inter-premolar Depth	C I	55	13.0327	2.30025	.267	.790
	C II	55	13.1455	2.11816		
2nd Inter-premolar Distance	C I	55	31.8273	2.92888	.729	.468
	C II	55	31.4327	2.74746		
2nd Inter-premolar Depth	C I	55	16.1473	2.31707	.688	.493
	C II	55	15.8400	2.36390		
1st Inter-molar Distance	C I	55	35.8418	2.56311	.799	.426
	C II	55	35.4145	3.02927		
1st Inter-molar Depth	C I	55	16.2709	2.49783	.495	.622
	C II	55	16.0400	2.39649		
Antero-posterior	C I	55	32.6618	4.80923	.529	.598
	C II	55	33.0800	3.35357		

Note: df=108

In this study, there were no significant differences found between the groups of class I malocclusion subjects and class II division 1 malocclusion subjects in the canine region. This result goes in accordance with the study conducted by Al-khateeb SN and Abu Alhaija ES,2016who concluded that there was no significant changes in the maxillary inter-canine arch

widthsand same was observed by Sayin MO and Turkkahraman H, 2014 who concluded that there inter-alveolar widths showed no difference between themand same findings were also obtained by Bishara*et al,* 1996. However according to a study conducted by Dolly Patel*et al* 2015, in contrast to our study class I group subjects showed significantly larger inter-canine widths than class II division 1 group subjects. This study by Dolly Patel *et al* 2015 was in accordance with the studies conducted byStaley *et al,* 1985and Huth*et al*, 2007.Our study was not in agreement with the study conducted by Munjal*et al,*2010 who reported class II division 1 subjects poses a narrower maxillary inter-canine widths when compared to class I group of subjects.
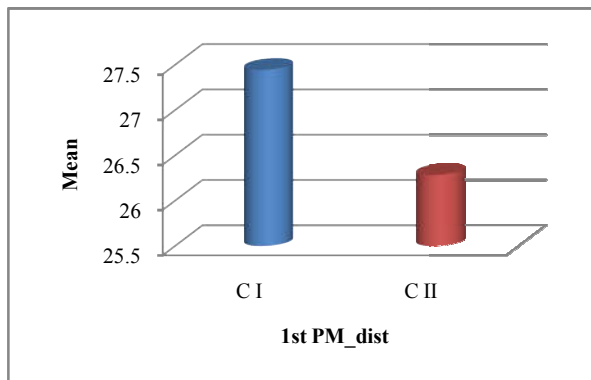
Graph 1 Comparison of 1st inter-premolar distance between Class I and Class II division 1 malocclusion groups.

According to our study a significant difference was found in the 1st inter-premolar widths (p<0.048), which signified that there is a prevalence of greater 1st inter-premolar distance in class I group of subjects when compared to the class II division 1 group of subjects.This finding was inaccordance to the results obtained from a study conducted by Al-Sayagh,2011 which stated that the 1st inter-premolar widths were seen to be smaller in class II division 1 malocclusion subjects compared to any other group subjects. In study by Sayin MO and Turkkahraman H,2004 on the other hand showed no differences in the inter-premolar widths in the 1st premolar region between the groups examined.

There was no significant differences found among the measurements of 2nd inter-premolar distances in this study which was contrary to the study of Sayin MO and Turkkaharman H, 2004in which the maxillary inter-premolar width was seen to besignificantly greater in class I malocclusion subjects than in class II division 1 subjects (p<.01).Study done by Bhalla*et al,*2011 was in support of our finding that no significant difference exists between the inter-premolar widths between different malocclusion subjects.

No significant differences were seen in the 1st inter-molar distances on comparing the two subject groups in our study, which could be correlated with the study conducted by Bhalla*et al,*2011 who found no significant difference among inter-molar widths of class I and class II division 1 malocclusion subjects. However in study contributed by Sayin MO and Turkkahraman H,2004it was seen that maxillary 1stinter-molar width was found to be significantly increased in class I malocclusion subjects, which was also supported by the study of Al-Sayagh,2011stating that class II division 1 malocclusion subjects had smaller maxillary 1st inter-molar width which may pointout that the values in a class I malocclusion subjects was greater than subjects in class 2 division 1 subjects. Lux*et al,*2003 in their study have found out that inter-molar widths were found to be 3-5 mm lesser in class II division 1 malocclusion subjects than in class Imalocclusion subjects.

Vertical dimensions: There were no significant differences observed in the two malocclusion subjects when comparing the palatal depth by joining and analyzing the landmarks in our study. In relation to study of this parameter alone much evidence was not available that supported the depth of the palatal vault at each tooth level, however, a few studies have definitely contributed to the findings of palatal depth.

In the study conducted by Al-Sayagh,2011 in contrast to our study it was concluded that class I malocclusion subjects showed shallow palatal vault whereas the vault depth was deepest in class II division 1 subjects, this report was in contrast to the study of Johnson *et al,*1994 who concluded that class I crowded subjects had the deepest palatal vault. This study of Johnson *et al* 1994 was in similarity of the study of Bhalla*et al,*2015 who also found the persistence of deep palate in class I malocclusion subjects and shallow in a class II division 1 groups. According to Zarringhalan M, 2004, the prevalence of deep palate was lesser in a classI malocclusion and class II division 1 malocclusion subjects when compared with class III malocclusion subjects which can be taken as a correlating factor to the findings of our study which shows no difference in the palatal depth parameters.

Sagittal Dimensions: According to the findings of our study, there were no significant differences found upon comparison of antero-posterior (sagittal) arch perimeters in class I and class II division 1 malocclusion subjects. A valid point exists while making the correlation between the antero-posterior archperimeter and the transverse dimensions as stated by Al-Sayagh,2011 that there is a positive correlation between theantero-posterior archparameters and palatal arch widths and poor correlation of antero-posterior archperimeter and arch heights, hence it suggested that as increment in the arch widths is anticipated there is also an expected increase in the antero-posterior archparameters particularly in the inter-molar arch levels and was not changed by the palatal heights. The significance of this correlation was found to be relevant in all the malocclusion groups and irrespective of the genders, therefore relating these factors it can be concluded that as there were no significant changes in the inter-molar widths in our study hence no significant changes were observed in the antero-posterior archparameters also. According to the findings of Eid AA *et al,*1987 in all the occlusal groups there was a positive correlation among the antero-posterior archperimeter measurements and molar depths, this finding also supportsour study that as there were no changes in the depth at the molars in both groups, the antero-posterior archperimeters remained constant.Paulino*et al,*2008also found a positive correlation with the inter-canine widths and antero-posterior archperimeters which was also not relevant to our study as there was no changes with respect tointer-canine widths. In contrast to our study, the antero-posterior archperimeter was greatest for class II division 1 subjects in the study done Bhalla*et al,*2011.

CONCLUSIONS

1. A significant difference was found on comparing the transverse arch widths in the 1st inter-premolar region showing that class I malocclusion subjects possessed a wider arch form in the 1st premolar region.
2. The present finding puts light on narrowness of arches belonging to class II division 1 malocclusion subjects and hence also projects the need for expansion to be undertaken in these malocclusion subjects as there is a tendency for the development of a cross-bite.
3. There were no significant differences observed in relation to the inter-canine width and depth, 1st inter-premolar depth, 2nd inter-premolar distance and depth and lastly 1st inter-molar distance and depths of all the subjects under study belonging to class I malocclusion and class II division 1 malocclusion subjects.
4. This method of assessment of palatal discrepancies were found in many studies conducted in the past with resultant conflicts of interest. Several reasons could be attributed to the existence of these differences namely ethnic and racial differences, gender dimorphism, sample selection, age factors of the subjects examined and severity of malocclusion.

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How to cite this article:

Raghunath N *et al*.2016, A Comparative Evaluation of Transverse, Vertical And Sagittal Arch Dimensions In Class I And Class IIDivision 1 Malocclusion Subjects In Karnataka Population. *Int J Recent Sci Res.* 7(12), pp.14853-14857.