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## Estimating the amount of crowding in different occlusal patterns

Mary Sheloni Missier\*<sup>1</sup>, Ashwin Mathew George<sup>1</sup>, Ashok Vardhan N<sup>2</sup>

<sup>1</sup>Department of Orthodontics, <sup>2</sup>Department of Biochemistry, BRULAC, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai 77, Tamil Nadu, India

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### ABSTRACT

Lower anterior dental crowding is one of the most common types of malocclusion which occurs in all 3 groups of Angle's classification. The awareness of the general population on orthodontic treatment though is on the rise compared to the western population the awareness among the Indian population is still on the downside. Is it the decreased prevalence in malocclusion or the decreased awareness in spite of the prevalence of malocclusion is the objective of this study. Little's index is used for the evaluation of the amount of crowding by the sum of the distance from the contact point of teeth in malocclusion to the ideal contact point when in alignment. This study involves a sample size of 30 patients with 10 in each type of occlusion. A pre-treatment model of each is taken, and the amount of crowding is calculated using a digital vernier calliper and evaluated it with little's index. It was found that class I had a greater amount of crowding followed by class II and class III. Various studies used different methods to measure the rate of crowding, but overall it was found that class I showed the highest prevalence followed by class II type of malocclusion followed by class III type of malocclusion.



### \* Corresponding Author

Name: Dr. Mary Sheloni Missier  
Phone: +91-9952375621  
Email: shelonibds@gmail.com

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### INTRODUCTION

Occlusion is termed as the relationship between the maxillary and the mandible teeth when they are brought into functional contact, on the other hand, malocclusion is defined as the state of any change in the occlusal pattern, according to the Glossary of Orthodontic Terms (John Daskalogiannakis *et al.*, 2000) According to Houston *et al.* Malocclusion is defined as an appreciable deviation from the ideal occlusion that may be considered aesthetically unsatisfactory

(Houston *et al.*, 1992) thus implying to the condition of imbalance in the relative sizes and position of teeth, facial bones and soft tissues (lips, cheek, and tongue). Malocclusion is a common condition in the modern civilization due to the adoption of soft food and lack of stimulus of the proper jaw growth, and proximal attrition of teeth, which in turn would help to the accommodation of teeth in dental arches in an aligned manner.

The World Health Organization in the year 1987 (Mundial Da Saúde *et al.*, 2009) had included malocclusion under the heading of Handicapping Dento- Facial Anomaly, which is defined as an anomaly which causes disfiguration which in turn would impede the function, and requiring treatment "if the disfigurement or functional defect was likely to be an obstacle to the patient's physical or emotional well-being".

Recently it has been found that the malocclusions feature the third highest prevalence among oral pathologies, second only to tooth decay and periodontal disease, and therefore malocclusion is found to rank third among worldwide Public

Health dental disease priorities (Mundial Da Saúde *et al.*, 2009)

Various factors have been found to influence malocclusion such as genetic factors, food habits, thumb sucking etc. On considering the genetic influence on malocclusion one of the previous genetic investigation (Ribeiro-dos-Santos *et al.*, 2001) have reported that a single Y DNA and mtDNA haplotype was found and a variation of 1–4 alleles from the autonomic loci, were found to be present in extreme cases of lineal fission. On comparing within the individuals, it was found that the molecular variance and genetic distance between these two Brazilian tribes were found to be greater when compared to that of the Amazonian tribes. It was found that the fission process was found to produce remarkable genetic differences between the villagers who were mainly due to marked genetic cohesion and a striking founder effect which resulted in malocclusion. On the other hand, other causes for malocclusion are the eating habits of the indigenous tribes inhabiting the Xingu region are predominantly traditional and more often based on cassava, nuts, fish, the meat of wild animals, sweet potatoes, yams, and wild fruits. Due to their coarse diet, they resulted in wear & tear. Therefore, there was no crowding

Carvalho *et al.* in his study he compared the people who intake a lot of processed food to the people who had coarse food (Carvalho JJ *et al.*, 1989). It was found that that the geographical location played an important role in the food habitat of the people. Due to the food habits, it was found that the children who had fine foods had crowding. Scientifically it has been proven by various experiments which were carried out on different subjects such as animal models. Skull remains of ancient populations and in human twins. & it was found that people with processed food had a greater rate of crowding compared to those who were subjected to normal food.

Tooth wear was examined through a slight modification of the classification system described by Mockers *et al.* (Mockers O *et al.*, 2004). For each, the biometric measurements were obtained for all indigenous participants in the permanent dentition stage and without tooth loss. The dental casts and intraoral photographs were obtained from 55 subjects & the tooth size, arch widths, diagonal length of the arches, dental crowding, and Little's irregularity index for the indigenous villagers were compared. The measurements from dental casts were obtained using a digital calliper (model Ultra-Cal Mark III; Fowler, Newton, Mass) with 0.01-mm sensitivity. Repeated measures of all subjects were performed after 30 days.

Therefore it is important to chart the progress of the crowding process to ascertain whether it is a continuous, gradual, slowly diminishing change, or whether it occurs rapidly at certain stages interspersed with periods of relative stability. Such information may have a bearing upon its aetiology.

Anterior dental crowding is the most common characteristic of malocclusion, but yet the term crowding is one of the most common terms used in dental vocabulary. Every individual such as patients, parents, the public, and the profession are unquestionably aware and concerned about dental crowding and seeking its correction. Terms such as dental irregularity, overlap, and crowding are the subjective, nonquantitative, even emotional terms which are used to represent malocclusion. Some of the adjectives used to quantify crowding are mild, moderate, severe, significant, etc. which are used since they are descriptively helpful but still allow a wide range of interpretation. Therefore in this study, we estimated the rate of crowding present in different types of malocclusion pattern.

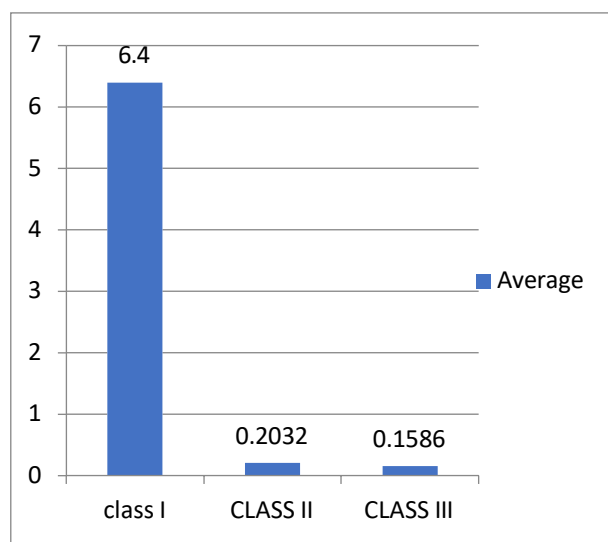
## MATERIAL & METHODS

This is the study which was done on Chennai population; the pre-treatment orthodontic cast was collected from the DEPARTMENT OF ORTHODONTICS SAVEETHA DENTAL COLLEGE AND HOSPITAL, CHENNAI. A total no of 30 subjects was taken, 10 in each group of malocclusion & the rate of crowding was evaluated based on "Little's irregularity index". The inclusion criteria for the present study are the patients with no pre-orthodontic treatment, no missing teeth, and severe crowding cases. The exclusion criteria for the present study are the patients with pre-orthodontic treatment & patients with missing teeth or spacing present between the teeth.

In our study we measured the linear distance between the anatomic contact point of one tooth to the adjacent anatomic contact point of mandibular anterior teeth, the sum of five measurements represents the Irregularity Index & it was cross verified between two inter-examiners. The measurements were tabulated & it was statistically verified by ANOVA test.

## RESULTS

The values obtained were tabulated & ANOVA test was calculated & it was found that the class I type of malocclusion showed the highest prevalence followed by the class II type of malocclusion followed by class III type of malocclusion.



**Figure 1: Prevalence of the highest amount of crowding**

## DISCUSSION

In our study, we compared the rate of crowding present in different types of malocclusion & it was found that the class I showed the highest amount of malocclusion followed by class II type of malocclusion followed by class III type of malocclusion. Various other studies showed different percentage of prevalence of malocclusion such as Proffit WR *et al.*, 1998 found in untreated White Americans of 8 - 50 years ago, the Angle's Class I malocclusions was most prevalent, i.e., 52.2%, while 42.4% were Angle's Class II and less than 5% were Angle's Class III malocclusions. Another study on the pattern of malocclusion in Africa (Nigeria) (Onyeaso CO *et al.*, 2002) showed Angle's Class I at 76.5%, Class II 15.5% and Class III 8.0%.

Another study by DaCosta (Da Costa OO *et al.*, 1999) found only 1.7% children in Northern Nigerian had Angle's class II division 2 malocclusion, while Ajayi<sup>8</sup> found it at 0.5 % level in his study. However, a study in the British population shows higher prevalence rates ranging from 8 - 27% (Gardiner JH, 1956; Foster TD, 1974; Haynes S, 1970).

The frequency of Angle's class III malocclusion of 10.3 % in our sample, but it is different from the

low prevalence reported in Nigerian children (Otuyemi OD *et al.*, 1993. Ogunyinka A *et al.*, 1999) and of 1% in Tanzanian children (Kerusuo H *et al.* 1988). However, Garner & Butt 1985 (Garner LD *et al.*, 1985) in their study on Kenyan children found a higher prevalence of 16.8% of Class III. By these studies, we found that the genetic factors, food habits, & their lifestyle had a greater influence on malocclusion

There are various methods to estimate the rate of crowding such as the use of brass wire/calliper method, reflex microscopy etc. It was found that the use of brass wire or calibre method tended to underestimate the degree of crowding, some studies compared the brass technique with the other two techniques it was found that the results showed higher values when brass wire method was used compared with those obtained with the reflex microscope. The use of the reflex microscope with its customized computer program has come into existence to determine the degree of dental crowding, to overcome some of the potential problems which are faced while estimating the simple crowding & the arch length analysis method. All these methods have advantages and limitations and their results will be dependent upon various factors such as the operator's experience, the accuracy of the appliance, and the case itself.

In the present investigation, the Irregularity Index has been used for the assessment of dental crowding. The various author has used a different method such as cephalogram, irregularity index, reflex microscopy computer program etc. in estimating the rate of crowding. Malibu *et al.* & Musich *et al.* have stated (Maliu AN *et al.*, 1994 and Musich *et al.*, 1973) that the irregularity index showed higher scores in-cases of severe labio-lingual displacement of one or more anterior teeth. It is found that the index is one of the reliable methods for the assessment of crowding based on the scoring we can determine whether it is severe or mild crowding in cases with less than 2mm of linear displacement it is considered to be normal and those with more than 4mm of the score it is considered as crowding. On considering the

**Table 1: Mean between groups**

Groups	Count	Sum	Average	Variance
class I	10	64	6.4	1.728889
CLASS II	10	2.032	0.2032	0.012255
CLASS III	10	1.586	0.1586	0.067573

**Table 2: Comparison between groups**

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	257.858	2	128.929	213.8461	2.78E-17	3.354131
Within Groups	16.27845	27	0.602906	??	??	??
Total	274.1364	29	??	??	??	??

cephalometric measurements, the linear distance of S-SE plane showed varying differences between normal & crowded groups. On comparing it was found that the normal group showed larger values of the anterior cranial base measurements when compared with the crowded group. But it is just the opposite when the posterior cranial base measurements are considered they showed larger values of the posterior cranial base in the cases of crowding.

Based on the inferences of various studies which compared the normal & crowding patient using cephalometric measurements we found that the normal individuals had longer anterior cranial base lengths and the individuals with crowded teeth had longer posterior cranial base lengths. Furthermore, the discriminate analysis showed that the posterior cranial base (S-Ba) was proved to be an effective variable in discriminating between these groups. Therefore the results lead to the belief that the cranial base structures play an important role in differentiating the normal & crowded group. On the other hand on taking the reflex microscope's computer program, there was no need to record arch perimeter directly which proved to be the valuable reason to overcome the potential drawback of the brass wire/calliper method. In reflex microscopy method, the estimation of the degree of dental crowding was done by subtracting the sum of the total tooth widths (space required) from the arch perimeter (space available). The reported limitation of the brass wire method is summed up by Huckaba (Rudge SJ *et al.*, 1983), 'in cases in which the teeth are badly crowded or overlapped, the mean arch alignment is used'. This means that the examiner must use individual judgement in the determination of this mean alignment which, in turn, is related to the interpretation of the arch form presented by the individual case. It is noted that greater the crowding more the arch form is obscured. This justifies the possible reason for which the mean arch perimeter measurements in both upper and lower arches were found to be higher than the values recorded by the reflex microscope. Musich and Ackerman (Musich DR *et al.*, 1973) and Rudge *et al.* (Huckaba G W *et al.*, 1964) found that the mean arch perimeter values were found to be higher when measured using brass wire method than compared to that of the means obtained from the direct electronic digitization of study models.

On comparing various studies, the aetiology of crowding was determined & it was found that there was an increased rate of crowding (71.2 %) in the sample examined. Although the frequency of crowding was more in females as compared to

males, the difference was not statistically significant. Drummonds (Musich D *et al.*, 1973) found only 40 % of children having crowding in the study done in South Africa. The high percentage of crowding may be partly explained by the frequent occurrence of caries and molar extractions, which favours the migration of first permanent molars, inclinations and rotations (Rudge S J *et al.*, 1983). Genetics and racial differences controlling the growth of jaws; evolutionary trends in jaw growth; premature extractions of baby teeth without any space maintenance; unrestored caries and space loss; Ibyinyo (a type of oral mutilation i.e. a traditional practice in some parts of Rwanda and Africa where the tooth buds of certain baby teeth are gouged out at an early age to prevent GIT infections in a child); iatrogenic malocclusion created by extraction of certain permanent teeth by non-orthodontists & other dentists etc can be some of the factors which may have contributed to increased crowding, which should be looked into in future studies. In the posterior segments, these events are associated with the early loss of deciduous molars and, consequently, loss of space. On the other hand, spacing was found to be present in only 9.9 % cases, thus showing the general trend worldwide that crowding is more prevalent than spacing due to evolutionary trends and dietary habits. By these studies, we conclude that an awareness campaign should be conducted so that we can reduce the cause for crowding which in turn would result in the reduction of the percentage of the prevalence of crowding.

There are various studies which compared the various methods in determining the rate of crowding & their aetiology for crowding but there are very few studies which compared the rate of crowding in different malocclusion patterns & it was found that the rate of crowding & the prevalence of malocclusion varied depending on different regions depending on their habitat, culture, genetics etc. In our study, we found that class I showed the highest rate of malocclusion followed by class II malocclusion & class III type of malocclusion, but we compared the rate of crowding among a minimal group of subjects & we did not compare between male & female therefore further studies with a larger no of subjects is required.

## CONCLUSION

Various studies used different methods to measure the rate of crowding, but overall it was found that class I showed the highest prevalence followed by class II type of malocclusion followed by class III type of malocclusion.

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