

# Tooth Size Discrepancy among Different Malocclusion Groups in a Libyans Sample

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Citation: Abdalmawla Alhussin Ali Ali, Belgasem KA (2021) Maximum Mouth Opening among Libyan Population. J Dent Oral Care Med 7(1): 104

Received Date: November 13, 2021 Accepted Date: December 27, 2021 Published Date: December 27, 2021

## Abstract

Tooth Size Discrepancy (TSD) forms part of the initial diagnosis and is considered when formulating a treatment plan for the individual patient.

**Objectives:** The present research aimed at determining the extent and prevalence in a representative orthodontic population in Libya, to determine the prevalence of tooth size discrepancies (TSDs) in orthodontic population among different malocclusion groups.

**Material and Methods:** The sample comprised 60 pretreatment study casts with fully erupted and complete permanent dentitions from first molar to first molar, and subdivided into three types of occlusion. The mesiodistal width of the teeth was measured at contact points using a stainless steel digital caliper and Bolton analysis was carried out on them.

**Results:** No significant differences were observed for the overall TSD of gender.

**Conclusions:** There were no statistically significant differences of overall and anterior TSD with regard to gender or malocclusion.

**Keywords:** Tooth Size Discrepancy; Bolton Analysis; Bolton Ratio, Crowding Of Teeth, Sirte –Libya

## Introduction

A tooth size discrepancy (TSD) is a disproportion among the sizes of the individual teeth. TSD is defined as the lack of harmony of size of individual tooth or groups of teeth when related to those within the same arch or the opposing arch [1]. An appropriate balance of mesiodistal tooth widths between maxillary and mandibular arches is needed to achieve the best possible esthetic and functional results at the completion of treatment [1]. For good occlusion, the upper and lower teeth must be proportional in size. If large upper teeth are combined with small lower teeth, as in a denture setup with mismatched sizes, there is no way to achieve ideal occlusion.

Some studies had described different methods for measuring tooth size discrepancy; [2,3] the most recognized method is Bolton's tooth size ratio. Bolton (1958) established two ideal ratios to evaluate the tooth size discrepancy (TSD). Overall tooth size ratio is the summed all mesiodistal widths of mandibular to maxillary teeth excluding permanent second and third molars. Anterior ratio is summed mesiodistal widths of the lower to the upper anterior teeth. Bolton had concluded that the normal ratio for normal occlusion is an overall ratio and anterior ratios are 91.3% and 77.2%, respectively [1].

Racial differences have been found to be an influence the tooth size with different malocclusions groups [4,5]. While in general men have bigger teeth than women [3], this does not mean that they have larger tooth size ratios or an increased prevalence of TSDs. Various studies have studied sex differences in relation to TSD. Smith et al. found that males had a larger ratio than females but the differences were small and much less than one SD from Bolton norms no significant [6]. This was confirmed by Mirzakouchaki et al. [7] in an investigation of Iranian-Azari subjects. Previous study [8] found that males have larger teeth than females. Despite the difference most studies have found that there is little impact of gender on interarch ratios [9-12]. Studies were also used to detect the TSDs incidence among various malocclusion groups. TSDs are more common in Class III malocclusions [13-15] and in Class II division 1 malocclusions [5].

Much research has been carried out to document tooth size discrepancy in several populations, but very few were performed in Sirte, Libya. Therefore, the aim of this study was to determine the tooth size discrepancy in a sample of patients seeking orthodontic treatment, to investigate the prevalence of Bolton anterior and overall tooth size discrepancies and to compare the effect of gender on the measured parameters in this sample.

## Methods and Materials

The research consisted from 60 sets of pre-treatment orthodontic casts were randomly from subjects 32 patients were male and 28 were female, age ranged between 13 and 23 years and mean age was 18.6 years and subdivided into different types of malocclusion (Class I, Class II division 1, Class II division 2 and Class III malocclusions). The distribution according to malocclusion and gender group is shown in (Table 1). The sample was identified that fulfilled the following criteria:

- Age range (13 – 23 years)
- Fully erupted and complete permanent dentition
- Good quality of pre-treatment models
- No extraction or tooth agenesis
- No tooth wear or mesiodistal restorations
- No abnormalities in tooth morphology
- No previous orthodontic treatment
- No retained primary teeth

The mesiodistal diameter tooth sizes were measured by Dr. Abdalmawla Ali on the orthodontic casts from first molar to first molar using digital calipers. The measurements were obtained on proximal surfaces at the greatest distance between the contact points.

For each orthodontic models Bolton analysis both anterior and overall ratios were calculated. In order to calculate the error of the method, Dahlberg's formula [16] was applied. The measurement is repeated one month after the initial measurements for 20 models to assure accuracy, for intra-examiner reliability, Houston's [17] coefficient of reliability was calculated.

The mesiodistal widths of 12 maxillary teeth and 12 mandibular teeth from right first molar to left first molar are totaled and compared. These mesio-distal crown measurements were taken from mesial and distal contact areas, respectively (Figure 1). The dividend of two is the percentage relationship of mandibular to maxillary tooth size, which is called "overall ratio".

Classification of Malocclusion	Males N %	Females N %	Total N %
Class I	16 (26.7%)	14 (23.3%)	30 (50.0%)
Class II division 1	11 (18.3%)	7 (11.7%)	18 (30.0%)
Class II division 2	1 (1.7%)	3 (5.0%)	4 (6.7%)
Class III	4 (6.7%)	4 (6.7%)	8 (13.3%)

**Table 1:** The distribution according to malocclusion and gender group

## Statistical Analysis

Statistical analysis was performed using the Statistical Package for Social Science (SPSS17.0, SPSS Inc., Chicago, USA) Descriptive statistics (means and standard deviation) were calculated for each tooth in the different groups of malocclusion was calculated. Student's t-test was conducted to detect the differences between the two groups. Statistical differences were determined at the 95% confidence level ( $P < .05$ ).

Patients' name:		Date of Examination:		Gender:		Age:					
Type of Malocclusion:											
6	5	4	3	2	1	1	2	3	4	5	6
6	5	4	3	2	1	1	2	3	4	5	6
Mesiodisal width in (mm):											
$\frac{\text{sum of mandibular 12}}{\text{sum of maxillary 12}} \times 100 = \text{Overall Ratio}$											
Mean: 91.3% (SD: ± 2)											
Range: 89.3–93.3											
$\frac{\text{sum of mandibular 6}}{\text{sum of maxillary 6}} \times 100 = \text{anterior Ratio}$											
Mean: 77.2 (SD ± 2)											
Range: 75.2-79.2											

**Figure 1:** The form of calculating the tooth size discrepancy

## Results

Our sample was construed of 32% males and 28 % females (Figure 2). From this sample 50.0 % had class I malocclusion, 30.0 % class II division1 and the remaining divided between class II division2 and class III (6.7%) (13.3%) respectively as shown in (Figure 3). Figure 3 shows increase percentage of Class I and Class II division 1 malocclusions while the percentage is decreased in Class II division 2 and Class III malocclusions in the sample.

Descriptive statistics of mesiodistal tooth width compared to with the different malocclusion groups. In terms of gender, No significant differences were observed for the overall TSD. Both male and female measurements follow a similar pattern distribution. Table 2 compares the mean and standard deviation of the width of the maxillary and mandibular teeth in the right and left sides. No Statistically significant differences were found in maxillary and mandibular teeth.

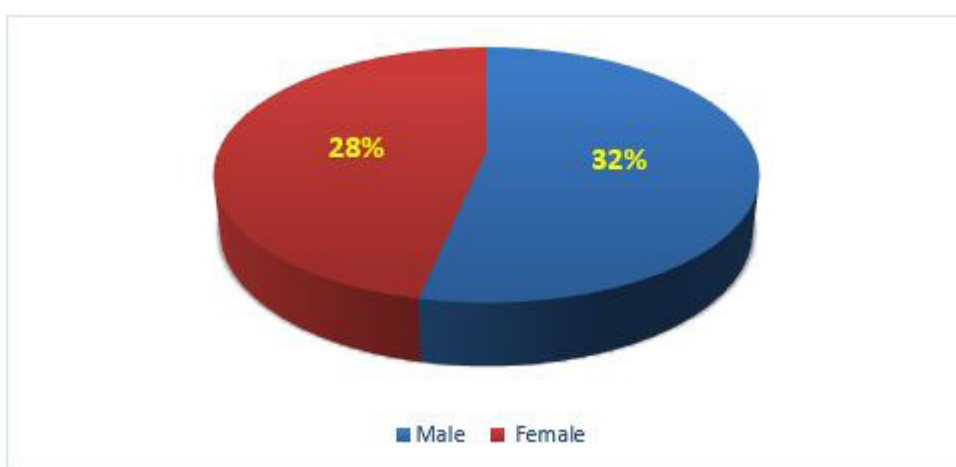


Figure 2: Percentage of males and females in the study

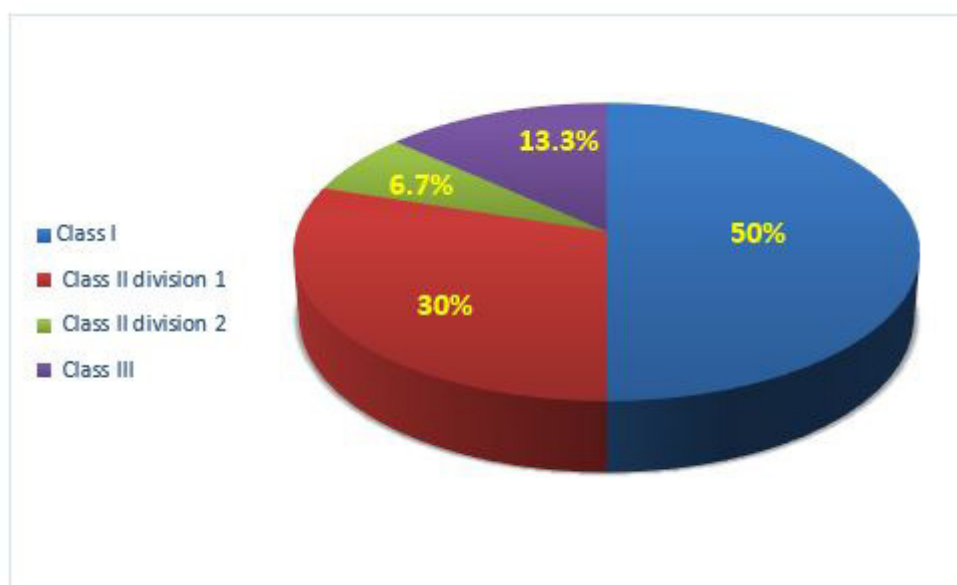


Figure 3: Percentage of different malocclusions in the subjects of the study

Arches	Class	Right		Left		P value
		Mean	SD	Mean	SD	
Maxillary	Class I	8.1	1.71	8.2	0.85	NS
	Class II	6.2	0.71	6.7	0.67	NS
	Class III	6.7	1.06	7.7	0.63	NS

NS indicates Non-significant-value

**Table 2:** Compares the mean and standard deviation of the width of the maxillary and mandibular teeth in the right and left sides ean SD

## Error of the method

Dahlberg's error for mesiodistal tooth width was 0.01 mm. Houston's coefficient of reliability was 91 %.

## Discussion

The importance of tooth size discrepancies in orthodontic diagnosis has been widely reported in the literature and accepted by the orthodontic community because the relationship between the upper and lower anterior dentitions is related to orthodontic finishing excellenc. In our study, a comparison was made between TSD in different malocclusion groups.

This study separated sexes and demonstrated no sexual dimorphism for tooth size ratios. This is similar to the findings by Crosby and Alexander [5], in their study, it was not clear whether there was sexual dimorphism for tooth size ratios.

In this study a comparison was made between the left and right segments of both maxillary and mandibular arches. There was no significant difference found between left and right maxillary teeth in the mesiodistal width.

## Conclusion

There were no statistically significant differences of overall and anterior TSD with regard to gender or malocclusion. The results help in treatment planning, putting in consideration tooth size discrepancy and decision for extraction.

## Recommendation

A larger study at the national level is required to verify the applicability of these results to our population and also to compare between tooth size and arch length.

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