

Tooth Size Discrepancies in Libyan Class I and II Orthodontic Patients Cross Sectional Retrospective Study

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Abstract

Aim: The aim of this study was to determine the prevalence of tooth size discrepancies (TSDs) in Libyan orthodontic population with Class I and II malocclusions.

Materials and Methods: From 300 pretreatment sets of orthodontic models at an orthodontic clinic, 52. 26 male 26 were female. were selected (26 Class I and 26 Class II) for adult patient with age less than 25 years (mean 18.1 years; SD ± 3.66 The overall and anterior tooth size ratios were calculated. In order to assess the error of the method, 20 study casts were randomly chosen from the sample and remeasured 3 weeks later by the same investigator. One sample t-test was used to compare the mean anterior as well as overall ratio with the original Bolton while two-way analysis of variance (ANOVA) (0.05) was used for comparing the values for both the malocclusion types.

Result: No statically significant differences were found for the mean anterior ($P = 0.997$) as well as for overall ratio ($P = 0.768$) for both patients with Class I and II malocclusions. The mean anterior and overall ratio were comparable with the original Bolton norm (77.1 and 99.3 respectively). However, clinically significant differences were found for the slandered deviation for both the ratios among the malocclusion group (SD 3.01 for anterior and 3.2 for overall ratio).

Conclusion: There were no statistically significant differences among the groups for overall and anterior ratios. Both Class I and II malocclusion groups had discrepancies greater than 2 slandered deviation from the Bolton mean. Further studies are needed with larger sample.

Introduction

Specific dimensional relationships must exist between the maxillary and mandibular teeth to ensure proper interdigitation, overbite, and overjet.^{1, 2} Discrepancies in tooth size should be known early during the initial diagnosis and treatment planning stages if perfect results in orthodontic finishing are to be achieved.³ Many investigators give interest to the harmony between the upper and lower dental arches.⁴⁻⁹

Stifter J¹⁰ replicated Bolton's study on Class I occlusion subjects and reported similar results. Lavelle^[11] showed that there was sexual dimorphism in tooth dimensions and in the ratio of upper to lower arch tooth size. Arya et al.^[12] observed tooth size differences between genders, in agreement with Moorrees et al.¹³, Lysell and Myrberg^[14], Smith SS et al.¹⁵ and Uysal T 16, Sperry TP et al.¹⁷ analyzed the Bolton ratios for groups of Class I, Class II and Class III cases. He found that Class III subjects showed greater mandibular tooth size excess than the Class II and I groups did.

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All publications are listed in Table 1. Most of the studies were based on patients applying for orthodontic treatment with different malocclusions.¹⁸⁻³² The sample sizes varied between 55 and 710.

e treatment. An esthetic and balanced occlusion can be considered normal, even presenting teeth with slight rotations, slightly increased or decreased overjet and overbite and mild incisor buccal or lingual tipping. The curve of Spee, cusp height, the relation of each tooth with its antagonist and other occlusal characteristics can vary considerably

The aims of the present study were (1) to determine whether there is a difference in intermaxillary tooth size discrepancies among the malocclusion groups classified by dental and skeletal variables, and (2) to determine the percentage of tooth size discrepancies outside 1 or 2 standard deviations (SDs) from Bolton's mean.

Materials and Methods

From 300 pretreatment sets of orthodontic models at an orthodontic clinic, 52 were selected (26 Class I and 26 Class II) for adult patient with age less than 25 year (mean 18.1 years; SD ± 3.66). The following study model selection criteria were used:

1. Good quality models of the normal occlusion and pretreatment models of the malocclusion groups.
2. All permanent teeth erupted except second and third molars.
3. No mesiodistal or occlusal tooth abrasion.
4. No residual crown or crown-bridge restoration.
5. Absence of tooth anomalies regarding form, structure, and development.

The mesiodistal crown diameters of all teeth were measured according to the method described by Moorrees et al. (1957), i.e. from the mesial contact point to the distal

contact point at the greatest interproximal distance. The individual tooth diameters were summed to derive the anterior (canine to canine), posterior (first molar to first premolar), and overall (first molar to first molar) arch segments. The segments were used to define the following ratios:

- **Overall ratio:** overall mandibular arch segment divided by the overall maxillary arch segment.
- **Anterior ratio:** anterior mandibular arch segment divided by the anterior maxillary arch segment.
- **Posterior ratio:** posterior mandibular arch segment divided by the posterior maxillary arch segment.

The overall and anterior ratios for each model pair was calculated using the following equations: Overall ratio = sum of the mesiodistal diameter of 12 mandibular teeth x 100/ sum of the mesiodistal diameter of 12 maxillary teeth; Anterior ratio = sum of the mesiodistal diameter of 6 mandibular teeth x 100/ sum of the mesiodistal diameter of 6 maxillary teeth. These ratios were taken from the records proposed by Bolton (8) and compared to the normal values. Overall, anterior, and posterior ratios were computed for all subjects whose values were outside 1 or 2 SDs from the mean value

Statistical Analysis

The overall and anterior tooth size ratios were calculated. In order to assess the error of the method, 20 study casts were randomly chosen from the sample and remeasured 3 weeks later by the same investigator. One sample t-test was used to compare the mean anterior as well as overall ratio with the original Bolton, while two-way analysis of variance (ANOVA) (≥ 0.05) was used for comparing the values for both the malocclusion types.

Coefficients of reliability were computed as 0.942 and 0.965 for overall and anterior ratio, respectively.

Table 1. Anterior and overall tooth size discrepancy (%) in different populations

| Author | Year of publication | Population | Occlusion | Sample size | Anterior ratio | Overall ratio |
|--------------------------------|---------------------|------------------------------------|----------------------|-------------|----------------|---------------|
| Freeman et al. | 1996 | American orthodontic | No data | 157 | 77.8 | 91.4 |
| Nie Q, Lin J ⁹ | 1999 | Chinese orthodontic | Class I, II, and III | 300 | 81.52 | 93.27 |
| Santoro M et al. ¹⁷ | 2000 | Dominican orthodontic | No data | 54 | 78.1 | 91.3 |
| Ta Ta et al. ²¹ | 2001 | Chinese selected schoolchildren | Class I, II, and III | 110 | 77.5 | 90.9 |
| Alkofide and Hashim | 2002 | Saudi Arabian selected orthodontic | Class I, II, and III | 240 | 78.86 | 92.61 |
| Araujo and Souki | 2003 | Brazilian orthodontic | Class I, II, and III | 300 | 78.18 | No data |

| | | | | | | |
|--------------------------------|-------|---------------------------|--------------------------|-----|-------|---------|
| Redahan and Lagerström | 2003 | Swedish orthodontic | Different malocclusion s | 137 | 78.0 | No data |
| Baidas and Hashim | 2005 | Turkish orthodontic | No data | 184 | 79.11 | 92.03 |
| Al-Tamimi and Hashim | 2005 | Saudi Arabian orthodontic | Normal | 65 | 77.4 | 91.4 |
| Nourallah et al. | 2005 | Syrian orthodontic | Class I | 55 | 78.99 | 92.26 |
| Uysal T, Sari Z ²² | 2005 | Turkish orthodontic | Class I, II, and III | 710 | 78.26 | 89.88 |
| Uysal T, Sari Z ²³ | 2005 | Turkish orthodontic | Normal | 150 | 78.26 | 89.88 |
| Paredes V et al. ¹⁴ | 2006b | Spanish orthodontic | No data | 100 | 78.32 | 91.97 |
| Akyalcin et al. | 2006 | Turkish orthodontic | Class I, II, and III | 152 | 78.15 | 91.34 |
| Fattahi et al. | 2006 | Iranian orthodontic | Class I, II, and III | 200 | 79.01 | 91.68 |
| Endo et al. | 2007 | Japanese orthodontic | Class I | 60 | 78.39 | 91.6 |

Results

The results showed that the measurements could be repeated with high accuracy. No statically significant differences were found for the mean anterior (P= 0.997) as well as for overall ratio (P = 0.768) for both patients with Class I and II malocclusions (Figure 2 and 3). The mean anterior and overall ratio were comparable with the original Bolton norm (77.1 and 91.4 respectively) (Table 1 and 2). However, clinically significant differences were found for the slandered deviation for both the ratios among the malocclusion group (SD 3.01 for anterior and 2.9 for overall ratio).

Table 2. Comparison between the Bolton mean and standard deviation for anterior ratio with this study

| | Bolton | Present study |
|------------------------|-----------|---------------|
| Sample size | 55 | 52 |
| Mean | 77.2 | 77.1 |
| Range | 74.5-80.4 | 73-84 |
| Standard deviation | 1.65 | 3.017 |
| Standard error of mean | 0.22 | 0.592 |

Table 3. Comparison between the Bolton mean and standard deviation for overall ratio with this study

| | Bolton | Present study |
|------------------------|-----------|---------------|
| Sample size | 55 | 52 |
| Mean | 91.3 | 91.4 |
| Range | 87.5-94.8 | 85.5-98.30 |
| Standard deviation | 1.91 | 2.90 |
| Standard error of mean | 0.26 | 0.402 |

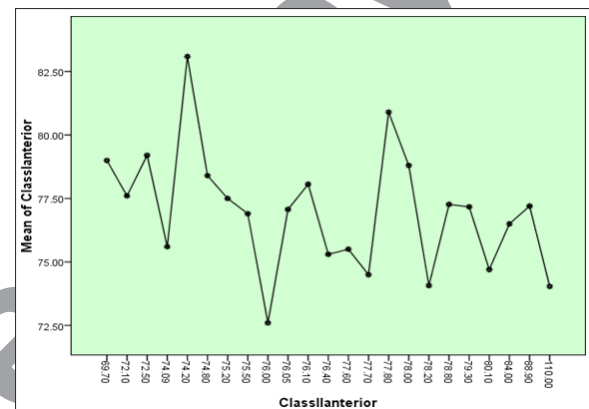


Figure 1. Correlation between the anterior ratio for Class I and Class II

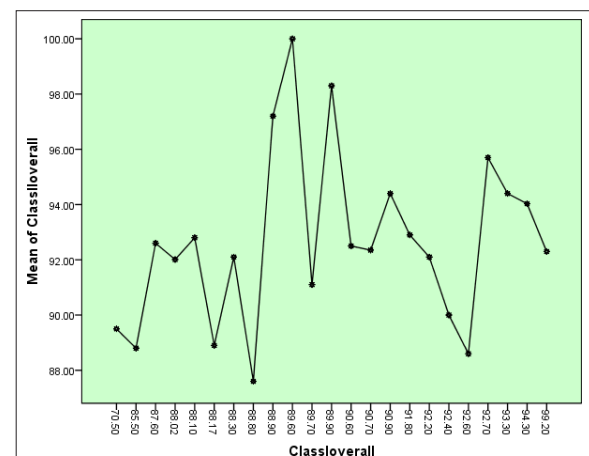


Figure 2. Correlation between the overall ratio for Class I and Class II

Discussion

In this study, the statistical analysis of Bolton anterior and overall ratios calculated in the three classes of malocclusion studied showed no significant differences. This finding was

in agreement with earlier studies done by other researchers. Crosby and Alexander⁹ found that there was no significant difference among Class I; Class II, division 1; Class II, division 2. However, they did not include Class III patients as in our study. They found that from the from a study on the white, blacks and Hispanics, significant differences were also found in the overall, anterior and posterior interarch ratios between the three populations (Smith et al. 2000) study on 180 preorthodontic casts¹⁴, the Bolton ratio are only applicable to their white females sample and concluded the ratios should not be indiscriminately applied to white males, blacks or Hispanics. It is because the relationships between the sizes of the mandibular and maxillary teeth are dependent on population, gender and arch segment lengths.

In the present study, the prevalence of a significant (exceeding 2 SD) discrepancy in overall ratio was 10.2%. Both Bolton WA^{3,4} and Proffit WR et al.³⁵ reported less than 5% of cases with an overall Bolton discrepancy exceeding 2 SD, but their studies included populations with excellent occlusion, which may be considered representative of the general population, but not of patients beginning orthodontic treatment.

Conclusion

There were no statistically significant differences among the groups for overall and anterior ratios. Both Class I and II malocclusion groups had discrepancies greater than 2 SD from the Bolton mean. Further studies are needed with larger sample. Bolton ratios in patients with malocclusions differ from Bolton's standards. Bolton discrepancy exceeding 2 SD and it is necessary to calculate Bolton's ratios in all orthodontic patients.

Conflict of Interest: None

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