ORIGINAL ARTICLE

Comparison of tooth size discrepancy in Angle's class I and class II malocclusion in Rajasthani population

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ABSTRACT

Aim: The purpose of this study was to compare the tooth size discrepancy according to Bolton ratios and norms between class I and class II malocclusion groups in Rajasthani population. **Materials and Methods:** A quantitative study was carried out at all dental colleges of Rajasthani. Cross-sectional data were gathered from the study casts of patients undergoing orthodontic treatment at all dental colleges of Rajasthan. 105 out of 150 study casts were filtered based upon the inclusion and exclusion criteria. The mesiodistal widths of all maxillary and mandibular teeth from right first molar to left first molar were calibrated with the use of a manual caliper. The readings were then used to compute the anterior and total Bolton ratios. **Results:** Significantly higher mean anterior tooth ratios were found for class II ($P < 0.01$) patients. All other ratios were within close range of Bolton's norms. **Conclusion:** Class II patients showed a tendency toward higher mesiodistal widths of teeth in the mandibular anterior region.

Key words: Angle's class I, II, Bolton's norms, interarch tooth size discrepancy

Introduction

Every orthodontist's goal is to successfully treat patients of malocclusion ensuring that treatment plan and orthodontic techniques are properly carried out. Orthodontic diagnosis and treatment planning require the patients' thorough history, extra and intra oral examination, analysis of diagnostic records comprising orthodontic photographs, necessary radiographs, and properly trimmed study casts. A great advantage of study cast analysis is that the degree of malocclusion can be diagnosed in three dimensions.[1]

Tooth size means the mesiodistal widths of the maxillary and mandibular teeth.[2] Specific dimension relationships must exist between the maxillary and mandibular teeth to ensure proper interdigitation, overbite and overjet.

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Among orthodontists, opinions vary widely concerning the frequency of significant tooth size discrepancy and the need to measure it in clinical practice.[3] Although the natural teeth match very well in most individuals, approximately 5% of the population has some degree of disproportion among the sizes of individual teeth.[4] Disproportion in the sizes of teeth between the maxillary and mandibular arches is not uncommon.[5-8]

Tooth size discrepancy is, usually, limited to a single tooth such as a peg lateral. A thorough evaluation of the amount of space to be created for the final restoration of such a tooth is essential. The presence of an abnormally large tooth in any arch may effect extraction decisions.

Tooth size analysis was presented by Bolton in 1958.[2] He computed the specific ratios of the mesiodistal widths that must exist between the maxillary and mandibular anterior segments as well as for the whole arch from right first molar to left first molar for proper coordination of maxillary and mandibular teeth. The ratio for anterior segment was derived to be 77.2 ± 0.22 and 91.3 ± 0.26 for the whole arch. The analysis is carried out by measuring the mesiodistal width of each permanent tooth.

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Then the ratios of the summed width of the maxillary to the mandibular anterior teeth and the total mesiodistal width of all maxillary to mandibular teeth are compared with Bolton's given ratios. A variation >2 standard deviation (SD) of the normal ratios is considered clinically significant.[6,9,10]

The purpose of this study was to compare the tooth size discrepancy according to Bolton ratios and norms between class I and class II malocclusion groups in Rajasthani population in India.

Materials and Methods

A cross-sectional study was carried out at all dental colleges of Rajasthan, cross-sectional data was gathered from the study casts of patients undergoing orthodontic treatment in all dental colleges of Rajasthan.

The Inclusion Criteria

1. Permanent dentition,
2. Presence of all permanent teeth from first molar to first molar in both arches and
3. No caries or extensive restorations on any of the teeth.

The Exclusion Criteria

1. Presence of any deciduous tooth/teeth,
2. Presence of any morphologic dental anomaly like mesiodens, taurodontism, etc.,
3. History of orthodontic treatment.

A thorough examination of all the study casts was done. All impressions of orthodontic patients were taken with a fast setting alginate. Impressions were poured with an orthodontic plaster, having a net expansion of 0.2%, after which they were trimmed. 105 out of 150 study casts were filtered based upon the inclusion and exclusion criteria.

The mesiodistal widths of all maxillary and mandibular teeth from right first molar to left first molar were calibrated with the use of a manual calliper. The readings were then used to compute the anterior and total Bolton ratios.

All data were analyzed using "IBM SPSS Statistics 20.0, USA statistical software." Mean and SD were calculated for anterior and total Bolton ratios for the whole sample and also for both groups individually. ANOVA was used to compare both groups with each other and also with Bolton's proposed norms for total and anterior Bolton ratios [Figure 1].

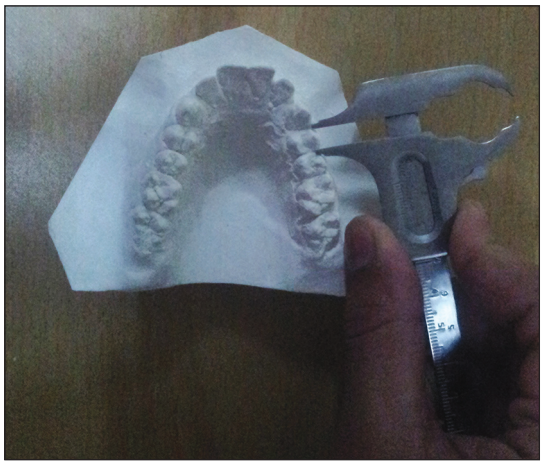

Figure 1: Measurement of teeth dimensions with caliper

Results

Of a total of 150 casts studied, 105 were filtered based on the above-mentioned criteria. Of these, 37 were of class I patients, 68 were of class II patients. A mean total Bolton ratio of 91.22 ± 2.93 and a mean anterior Bolton ratio of 78.91 ± 5.19 was found for the complete sample. The mean ratios for the different malocclusion groups are shown in Table 1.

The minimum total Bolton ratio calculated in the sample was 84.21 of a class II patient while the highest ratio calculated was 98.90 of a class I patient. ANOVA test failed to show any significant difference in the total Bolton ratios of different skeletal groups ($P > 0.05$) [Table 2].

The minimum anterior Bolton ratio calculated in the sample was 66.00 of a class I patient while the highest ratio calculated was 97.30 of a class II patient. ANNOVA test showed a significant difference for anterior Bolton ratios between Bolton's proposed norms and class II patients and also between class I and class II patients ($P < 0.01$) [Table 3].

Discussion

The importance of tooth size discrepancy in treatment planning has been the subject of various discussions in the orthodontic literature. In our study, a comparison was made between tooth size discrepancies in Angle's class I, II.

The mean total ratio for the whole sample was 91.22% which is very close to Bolton's proposed ideal ratio. However, the anterior ratio for the whole sample was found to be 78.91%, which is higher than Bolton's proposed

Table 1: Mean values for total and anterior Bolton ratios for different malocclusion groups

Group	Mean total ratio	Mean anterior ratio
Complete sample (*n*=105)	91.22±2.93	78.91±5.19
Angle's class I (*n*=37)	91.64±3.34	77.67±4.12
Angle's class II (*n*=68)	90.79±2.97	80.14±5.20

Table 2: Results for ANOVA and Tukey's test for total Bolton ratios

Class	*P*
Total Bolton	0.481
Class I	
Bolton's	0.953
Class II	0.418
Class II	
Bolton's	0.821
Class I	0.418

P < 0.05 is significant

Table 3: Results for ANOVA and Tukey's test for anterior Bolton ratios

Class	*P*
Total ANOVA	0.008*
Class I	
Bolton's	0.976
Class II	0.043*
Class II	
Bolton's	0.019*
Class I	0.043*

P < 0.05 is significant

ideal ratio, thus reflecting a tendency toward greater mesiodistal widths in the mandibular anterior segment in our population sample.

In a class, I patients, the mean total ratio calculated was 91.64%, and the mean anterior ratio calculated was 77.67%, both of which are close to Bolton's proposed ideal ratios. Similarly the total mean ratio calculated for class II (90.79%) and anterior is 80.14. A peculiarity was the finding of significantly higher ($P < 0.05$) mean anterior ratio (80.14%) for class II patients. This reflects a tendency toward wider mesiodistal dimensions in the mandibular anterior segment in our population sample. Usually, the opposite of this is assumed to be true. There was a significant difference in the anterior tooth ratios between class I and class II patients.

No correlation between Angle's classification of malocclusion and Bolton discrepancy was shown by Crosby and Alexander in 1989.[9] Their study included 109 pretreatment models of orthodontic patients of class I, class II Division 1 and class II Division 2 malocclusion.

Nie and Lin in 1999[11] studied 60 cases of normal occlusion and 300 cases of various malocclusion groups for interarch tooth size discrepancy. They found no significant difference between various malocclusion subgroups. However, class III cases showed the greatest discrepancy in both anterior and overall ratios, followed by class I and then class II.

In 2001, Ta *et al*.[12] studied Bolton's ratios in Southern Chinese children. Their sample included 50 class I cases, 30 class II cases and 30 class III cases that were randomly selected from 1247 children. No significant gender difference was found. A significant difference ($P < 0.05$) was found between class III groups and Bolton's norms for anterior ratio. For overall ratio, a significant difference ($P < 0.05$) was found between class II cases and Bolton norms and also between class II and class III cases ($P < 0.05$).

In 2002 Alkofide and Hashim[13] studied the intermaxillary tooth size discrepancy in Saudi population. The sample consisted of 240 subjects, 60 cases in each malocclusion group. A significant difference was observed only for anterior ratios in class III groups. However, a significant difference was found in all malocclusion cases as compared to Bolton's norms.

Laino *et al*.[14] found no relation between inter and intra arch tooth size discrepancy and malocclusion groups. Their sample comprised of 94 pretreatment models of orthodontic patients.

Araujo and Souki in 2003[15] studied 300 subjects who were allocated to three malocclusion groups with each group containing 100 individuals. The classification was done on the basis of ANB angle and Sassouni analysis. Significantly higher anterior mean ratios were found in class III groups as compared to class I and class II groups. Tooth size discrepancy was found to be more prevalent in the class I and class III groups.

In 2005, Uysal *et al*.[16] compared interarch tooth size discrepancy in 150 untreated, normal occlusion subjects and 560 patients of four different malocclusion groups. A gender dimorphism was found in the normal subjects. All malocclusion groups showed significantly higher overall ratios than normal occlusion groups ($P < 0.001$). However, no statistically significant difference was found between the malocclusion groups.

Basaran *et al*. in 2006[17] failed to show any gender dimorphism or statistically significant difference of Bolton's tooth size discrepancy among different malocclusion groups. The sample was of 60 normal occlusion groups

and 300 patients divided into various malocclusion groups on the basis of dental and skeletal pattern. The study was conducted in a Turkish population.

The results of this study are in partial agreement with some of the above studies in the fact that no significant difference was found between Bolton's norms and tooth size ratios in class I patients. The observation that class II subjects showed a significantly higher anterior ratio indicating a tendency toward wider mandibular teeth.

Conclusions

- Class I patients showed mean inter arch tooth size ratios within close range of Bolton's norms.
- Class II patients showed significantly higher mean anterior tooth ratios as compared to Bolton's norms. The mean total tooth ratios were within close range of Bolton's norms.
- Class II patients showed a tendency toward higher mesiodistal widths of teeth in the mandibular anterior region.
- Therefore, a larger study at the national level is required to verify the applicability of these results to our population.

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