

Orthodontic Treatment of 41 Patients with Tooth Size Discrepancy

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Abstract: Objective. To retrospectively study the better orthodontic method for individuals with tooth-size discrepancy through analyzing changes between pre-and post-treatment. **Methods.** 41 orthodontic patients with tooth-size discrepancy were selected. The mesiodistal diameters of teeth were measured with a pair of dividers (accurate to 0.1mm) and Bolton's indices were calculated. The patients were treated with straight wire appliance by extracting teeth, restoring correlated tooth and stripping of enamel, etc. **Results.** After treatment, the patients had normal overjet and overbite in anterior teeth and class I relationship inter-arch. **Conclusions.** It is necessary to be the proper Bolton ratio between inter-arch tooth sizes for the good occlusal relationship. The results suggested that dentists should always keep in mind the general Bolton ratios analysis between maxillary and mandible tooth size during the practice for each patient. [Life Science Journal. 2006;3(4):65-67] (ISSN: 1097-8135).

Keywords: tooth-size discrepancy; Bolton ratios; occlusal relationship

Abbreviations: BR: Bolton ratios; OC: occlusal relationship; TSD: tooth-size discrepancy

1 Introduction

In order to obtain excellent and stable occlusal relationship(OR), it is necessary to be the appropriate Bolton ratios(BR) between upper and lower dentitions. If the tooth-size ratios intermaxillary is disharmony, it is needed to select tooth extraction or decrease the width of related tooth or change the axial inclination degree of anterior tooth, etc.

2 Materials and Methods

2.1 Subjects

41 patients with tooth-size discrepancy(TSD) were selected from those who applied for orthodontic treatment in the First Affiliated Hospital of Zhengzhou University. There were 18 females and 23 males, whose age ranged from 12.5 years old to 21 years old. All were in the permanent dentition stage, with no evidence of attrition or interproximal caries and restorations. Alginate impressions of the dentitions were taken from each subject, and stone casts were prepared. Cephalometric analysis shows that 41 cases were all mild or moderate crowding, class I of bone and average growth direction.

2.2 Measurement of dental models

A pair of dividers with fine tips was used to measure the maximum mesio-distal widths of the teeth on dental casts of pre-post treatment. Using

the dividers, the measurements of each dental arch were recorded by punching along a straight line on a card^[1]. When punching adjacent measurements, one leg of the dividers was inserted into the previous pinhole so as to reduce the measurement error to a minimum. Anterior arch lengths (canine to canine) and total arch lengths (first molar to first molar) were then measured using a millimetre ruler. Then calculate the Bolton index and crowding. All the work was carried out by the author.

The Bolton anterior ratio (the ratio of the mesio-distal widths of six anterior teeth between upper and lower dentition) and the Bolton overall ratio (the ratio of the mesio-distal widths of the 12 teeth between upper and lower dentition) were calculated^[2].

2.3 Classification

All cases included 13 microdontia of upper lateral incisor which showed smaller mesio-distal width of lateral incisor and the larger sizes of the lower anterior teeth, 19 smaller Bolton anterior ratios which showed that the size of lower anterior teeth was smaller than normal(except for deformed crown and congenital loss), 6 larger Bolton anterior ratios which showed the size of lower anterior teeth was more than normality (except for deformed crown and congenital loss), 2 normal anterior Bolton ratios other than disharmony posterior ratios, 1 congenital absence of lower incisor leading to smaller size of lower anterior teeth.

2.4 Orthodontic treatment

Straight wire appliance was used to align and level dentition, then harmonize the relationship intermaxillary. After the fixed appliance was removed, Hawley retainer was worn.

For mild lateral incisor of microdontia, and mild crowding (< 2mm) in lower dentition, stripping of enamel of lower incisors was applied to obtain harmony tooth-size. On the contrary, if lower dentition crowding was severe, one lower incisor was extracted. For severe lateral incisor of microtooth and severe or moderate crowding, 4 premolars were extracted, and the deformed tooth was restored after orthodontic treatment. For 13 cases, one lower incisor was extracted from each 6 patients, 4 premolars were extracted from each 4 cases and restored deformed tooth after treatment, and stripping of enamel was used for 3 cases.

In order to obtain harmonious tooth size and excellent OR between upper and lower arch, for mild crowding, stripping of enamel and changing of axial inclination were used. For severe crowding, after extracting 4 premolars and leveling dentition, calculated Bolton index and selected stripping of enamel and changing of axial inclination.

After orthodontic treatment, the incisor was restored for 1 patient with congenital loss of lower incisor in order to obtain normal overjet, overbite and excellent posterior relationship. For disharmony posterior ratio, stripping of enamel was used to obtain good occlusion.

3 Results

There were normal overbite and overjet in anterior teeth and neutral occlusal relationship in posterior teeth. X-ray cephalometrics showed that the SNA, SNB angle and the anterior tooth protrusion degree were normal.

Typical case: Male, 14 years old, Han nationality. The relationship between upper and lower molars was distal cusp to cusp; 2.5 mm upper dentition crowding degree, 7 mm lower crowding, III degree deep overbite, II degree deep overjet. Upper tooth size was lower because of microdontia of lateral incisor. X-ray cephalometrics showed that (1) average growth pattern, (2) mandible bone retrusion, (3) normal protrusion of upper and lower incisors. Treatment process: lower central incisor was extracted and straight wire appliance was used. See Figure 1 for before and after treatment.

4 Discussion

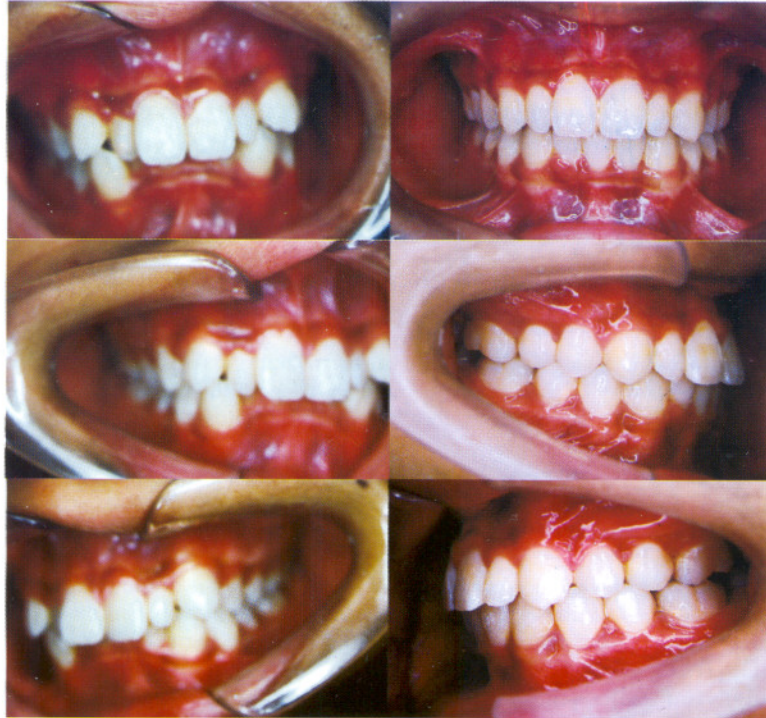
In 1960s, BR was indicated that appropriate ratio is very important for good occlusion. TSD is the factor of dentition crowding and space, disharmony of inter-arch and other complicated malocclusion. Studies have reported from 20% to 30% of people with significant tooth-size anterior discrepancies and 5% - 14% for overall TSD^[3]. A high prevalence of tooth size discrepancies in an orthodontic patient population and the statistically significant correlation of some of these with some dental characteristics suggest that the measurement of inter-arch tooth size ratios might be clinically beneficial for treatment outcomes^[4]. For these patients, it is necessary to measure and analyze Bolton anterior and overall ratio. Then the dentist will select relevant methods according to the degree of ratio disharmony.

In this article, 5 kinds of discrepancy were described for they were common in clinical practice. According to cast models analysis, cephalometric analysis and trial of aligning teeth, it wasn't difficult to make treatment planning.

In some cases, the finishing phase is very difficult, requiring the production of complicated biomechanical forces to reach a satisfactory orthodontic solution. A high percentage of these finishing-phase difficulties arise because of tooth size imbalances that could have been detected and considered during initial diagnosis and treatment plan^[5]. The correlation between anterior TSD and Angle's Class I, II, and III malocclusions, as well as their prevalence are as follows: (1) Individuals with Angle Class I and Class III malocclusions show significantly greater prevalence of TSD than do individuals with Class II malocclusions; and (2) Mean anterior TSD for Angle Class III subjects was significantly greater than for Class I and Class II subjects^[6].

In typical case, upper lateral incisor was not restored because of acceptable shape. After treatment, lower central incisor was consistent to facial midline. If the lateral incisor were restored after 4 second premolars extracted, the restoring process would be complicated and long. The patient and parents wouldn't accept this situation, so previously mentioned method was adopted.

In conclusion, it is necessary to analyze the BR before and during orthodontic treatment.



Left: before treatment Right: after treatment
Figure 1. Intra-oral photographs before and after treatment

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References

1. Baydas B, Oktay H, Metin Daqsuyu I. The effect of heritability on Bolton tooth-size discrepancy. *European Journal of Orthodontics* 2005; 27(1):98 – 102.
2. Bolton WA. Clinical application of a tooth-size analysis. *Am J Orthod* 1962; 48(7):504 – 29
3. Othman SA, Harradine NW. Tooth-size discrepancy and Bolton's ratios: a literature review. *Journal Orthod* 2006;33(1):45 – 51.
4. Akyalcin S, Dogan S, Dincer B, *et al.* Bolton tooth size discrepancies in skeletal Class I individuals presenting with different dental angle classifications. *Angle Orthod* 2006;76(4):637 – 43
5. Basaran G, Selek M, Hamamci O, *et al.* Intermaxillary Bolton tooth size discrepancies among different malocclusion groups. *Angle Orthod* 2006;76(1):26 – 30.
6. Araujo E, Souki M. Bolton anterior tooth size discrepancies among different malocclusion groups. *Angle Orthod* 2003; 73(3):307 – 13.

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