

Clinical Management of Tooth Size Discrepancies

Guest Experts

DAN GRAUER, DDS, PhD*

GAVIN C. HEYMANN, DDS, MS†

Associate Editor

EDWARD J. SWIFT, JR., DMD, MS

Esthetic anterior dental appearance depends on the alignment, occlusion, and exposure of anterior teeth.^{1–3} In order to establish adequate alignment and occlusion, the upper and lower incisors need to be proportional in size. Interarch tooth size discrepancy (ITSD) is defined as a disproportion in the mesiodistal dimensions of teeth of opposing dental arches. In the absence of a proportional match in size of upper and lower teeth, a normal occlusion is impossible.⁴

The prevalence of clinically significant ITSD among orthodontic patients has been reported to range between 17% and 30%.^{5,6} Although the prevalence of ITSD is higher in patients with malocclusion than in patients with normal occlusion,⁷ in general, there seems to be no difference among malocclusion groups, ethnicities, and gender.^{7,8} It is important to note that most studies comparing groups with regard to ITSD have been conducted in orthodontic populations.

DIAGNOSIS

The following clinical findings are associated with but not exclusive to ITSD: crowding or spacing of incisors, canines in dental Class II without skeletal Class II, excessive or deficient overjet, excessive or deficient overbite, vertical compensation of ITSD, wear and compensatory eruption of anterior teeth, excessive prominence of the marginal ridges of upper incisors and canines, and abnormal angulation/inclination of incisors and canines.

Given that these clinical findings are not specific to the presence of ITSD and that they are common findings in many types of malocclusion, a specific diagnosis of ITSD is needed. The gold standard for identification of a tooth size discrepancy is a diagnostic setup, but other diagnostic methods are available. The ratio of summed mesiodistal widths of the mandibular to maxillary teeth (either from first molar to first molar, or just the anterior teeth) can be compared with standardized values in order to identify and quantify a discrepancy.⁹ According to Bolton:

$$\text{overall ratio} = \frac{\text{summed mesiodistal widths of mandibular 12 teeth}}{\text{summed mesiodistal widths of maxillary 12 teeth}} \times 100 = 91.3\%$$

$$\text{anterior ratio} = \frac{\text{summed mesiodistal widths of mandibular 6 teeth}}{\text{summed mesiodistal widths of maxillary 6 teeth}} \times 100 = 77.2\%$$

As with any proportion, the result of the comparison could be higher or lower than the ideal percentage. For instance, in regards to the anterior proportion, if the ratio is less than 77.2%, it means that either the lower teeth are too narrow, the upper teeth are too wide, or a combination of both. If the ratio is higher than 77.2%, either the lower teeth are too wide, the upper teeth are too narrow, or both. It has been suggested that ITSD

*Assistant Professor, University of Southern California and Private Practice, Los Angeles, CA, USA

†Private Practice, Chapel Hill and Durham, NC, USA



FIGURE 1. General classification of interarch tooth size discrepancy.

must be greater than 1.5 to 2 mm to affect treatment planning and be deemed clinically significant.^{4,10,11} In a continuous spectrum of discrepancy between widths of upper and lower teeth, four discrete descriptions emerge; each discrepancy might present in a localized or generalized way (Figure 1).

CLINICAL DECISION MAKING

Regardless of the clinical continuum of ITSD, treatment options are discrete. For small ITSD (less than 2 mm), orthodontic compensation in the alignment and occlusion of the anterior teeth might be acceptable without altering the mesiodistal width of anterior teeth. For example, to compensate for a small ITSD in cases



FIGURE 2. A, This patient was referred to the orthodontist for space distribution prior to veneer restoration of her upper incisor to address an apparent interarch tooth size discrepancy (ITSD). At the beginning of treatment, mesiodistal teeth widths were measured and the ITSD was quantified as less than 1 mm. B, With orthodontic treatment only, we were able to compensate for the small ITSD. Patient did not require additive or reductive procedures, only orthodontic space closure and refining of occlusion. The bottom line: diagnose first and trust your measurements.

where the upper anterior teeth are too wide or the lower anterior teeth are too narrow, the orthodontist could finish the case with larger overjet and/or overbite, more inclination of lower incisor or less inclination of upper incisors. Conversely, in cases where the upper

teeth are too narrow or the lower teeth are too wide, the orthodontist can establish an occlusion with smaller overjet and/or overbite, less inclination of lower incisors and/or more inclination of upper incisors, or even in ideal overjet and overbite, but with canines in dental Class II relationship (Figure 2).

When the ITSD is greater than 2 mm, clinical management of tooth size discrepancy requires either the reduction of tooth width by means of interproximal enamel removal or the addition of tooth width by means of restorative dental techniques. When changes in mesiodistal widths are required, the orthodontist and restorative dentist must make two decisions (Figure 3):

- 1 Whether the discrepancy will be addressed in both upper and lower dental arches or in one arch only; and in the latter case, which dental arch will be treated.

Type of ITSD	Treatment
ITSD < 2mm	Orthodontic Compensation
<ul style="list-style-type: none"> •Localized Deficiency •Extreme Generalized Deficiency 	Addition Treatment (Increase tooth width)
<ul style="list-style-type: none"> •Generalized Excess •Generalized Deficiency (proportional teeth) •Localized Excess 	Reduction Treatment (Decrease tooth width)

FIGURE 3. Usual therapeutic approach for each category of interarch tooth size discrepancy.

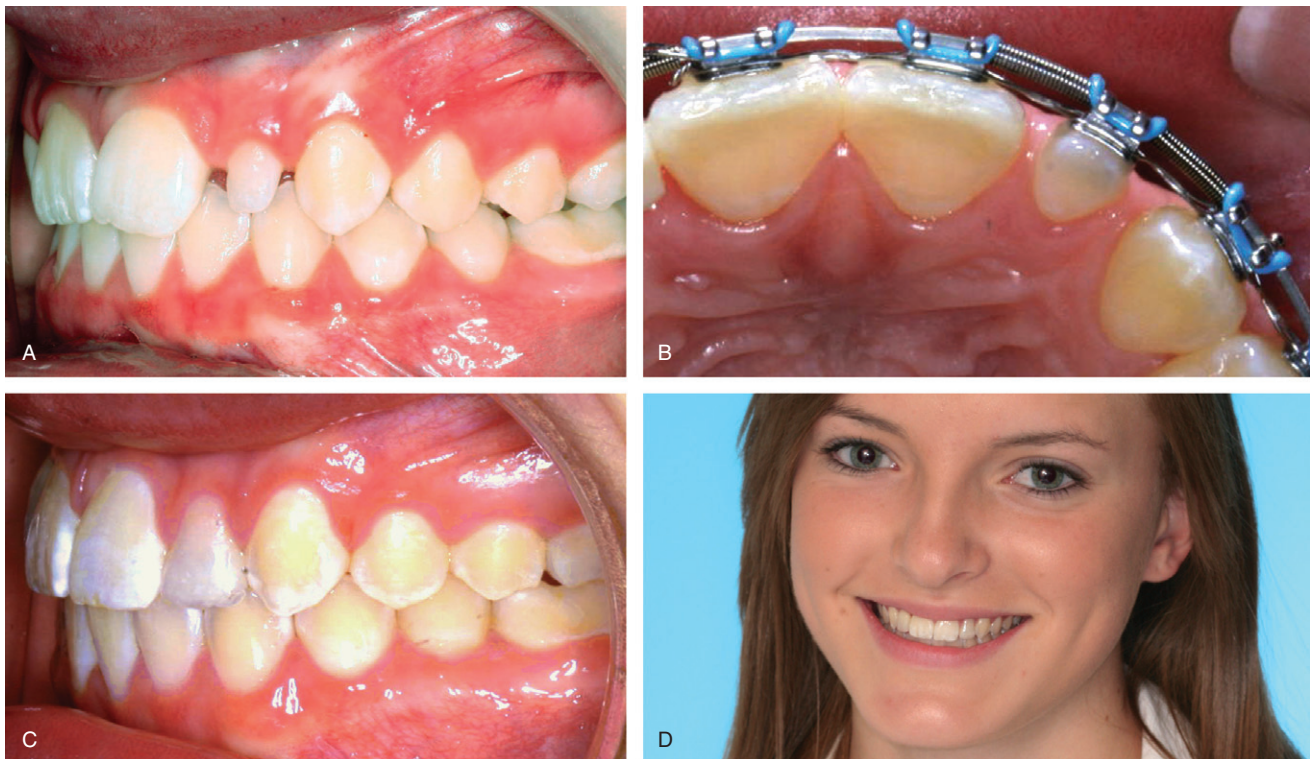


FIGURE 4. A, This patient had a localized ITSD. The upper left lateral incisor was disproportionately small in comparison with neighboring teeth and opposing dental arch. B, Through orthodontic treatment, the incisor was positioned in the appropriate space; 1/3 of the space was mesial and 2/3 of the space distal to the lateral incisor. C, This position allowed for restoration of optimal tooth contour. At the end of treatment, a composite buildup was used to restore to acceptable anatomy. D, The patient and her family were pleased with the esthetic result.

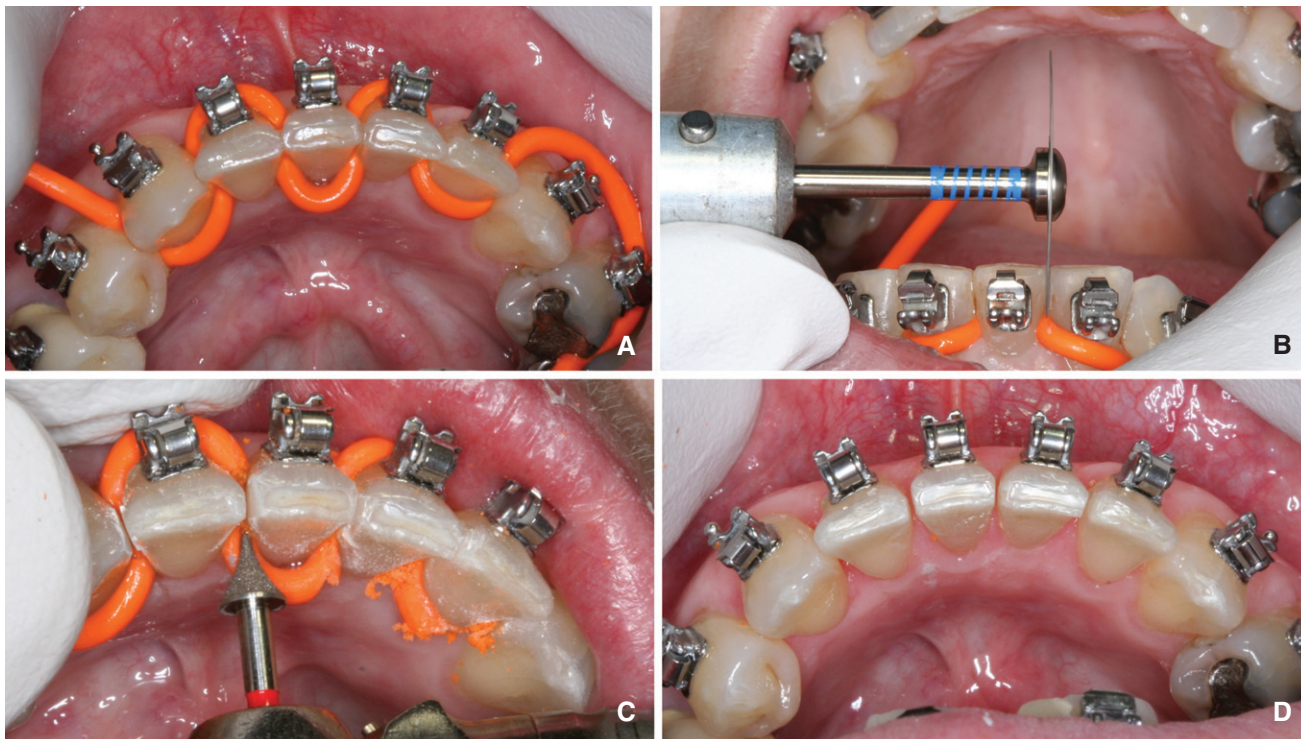


FIGURE 5. Reduction approach: clinical sequence of interproximal reduction. A, Teeth are separated and gingival tissues are protected with WedJet (Coltène Whaledent, Alstatten, Switzerland). B, A “honeycomb”-type disc in a reduced slow-speed handpiece is used to reduce the mesiodistal widths of the teeth, removing 0.2 to 0.5 mm of enamel. C, A cone-shaped diamond rotary instrument is used to create smooth and round line angles, restoring anatomical contours. D, After the procedure, spaces are evident between all incisors.

- 2 Whether the discrepancy will be solved by adding mesiodistal width to the teeth of one dental arch, reducing mesiodistal widths of the opposite dental arch, or both.

ITSD TREATMENT APPROACHES

The additive approach will often be used in ITSD cases with localized (small maxillary lateral incisor) or extreme generalized mesiodistal deficiencies (all incisors are undersized). The diagnosis of localized mesiodistal deficiency is relative to the adjacent teeth and can be assessed in anthropometric norms, in comparison with a normal-size contralateral tooth or determining the ideal mesiodistal width in proportion to the adjacent teeth (Figure 4).

When mesiodistal widths of adjacent teeth are proportional and no localized deficiency is found, a

reduction approach is more appropriate. For example, if maxillary anterior teeth display normal proportion among themselves, but are small overall, the correction of the ITSD will likely involve mesiodistal reduction of the mandibular anterior teeth. This reduction approach is normally used in cases with generalized deficiency or excess or cases with localized extreme excess.

Interproximal reduction can be accomplished with the aid of slow-speed rotary discs, abrasive strips, or high-speed diamonds (Figure 5). Care should be taken not to remove so much enamel as to completely eliminate it from the proximal surfaces of the teeth. This is of particular concern in the mandibular anterior area, where periapical radiographs may be helpful in quantifying the enamel thickness. Standardized reduction gauges that are accurate to the nearest tenth of a millimeter are helpful in quantifying the amount of reduction achieved. Interproximal enamel reduction rendering smooth self-cleansing surfaces has been

shown to pose no long-term negative prognosis to the teeth involved.¹²

CONCLUSION

Diagnosis and quantification of ITSD are essential for achieving optimum occlusion and esthetics. It is important to measure, diagnose, and make decisions prior to the initiation of treatment. The patient and all members of the treatment team should be informed about the problem, possible solutions, sequence, and timing.

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