

Seventh Key of Occlusion

Deepti S. Fulari¹, Sangamesh G. Fulari², Vishwal A. Kagi³, Jiwanasha M. Agarwal⁴

ABSTRACT

The presence of disproportionate tooth material in either arch can disturb the occlusal harmony. Boltons ratio, seventh key of occlusion aids in analyzing the proportionality of the maxillary and mandibular teeth. This analysis helps in diagnosing, analyzing and treating a case into a harmony resulting into structural and functional stability of upper and lower arch in any given case.

Keywords: Inter-arch discrepancy, Occlusal harmony, Proximal stripping

INTRODUCTION

A sequential planned treatment plan is the key for a successful orthodontic treatment. The 'goal of orthodontic treatment' should be aimed in achieving, optimal occlusion, ideal intercuspation, ideal overjet, ideal overbite and pleasing profile.

These goals can be achieved when Andrews's six keys of occlusion are achieved.¹ These six keys were considered to be the ideals, until McLaughlin and Bennet concluded that proper anterior and posterior fit cannot be achieved until the seventh key, 'boltons tooth size ratio' is fulfilled.²

BOLTONS ANALYSIS

Boltons ratio^{3,4} is a mathematical formula that gives the inter-arch discrepancy which lies only in presence of occlusal disharmony, i.e. variation in proportionality of tooth size of the upper and lower teeth. In order for maxillary teeth to fit well with the mandibular teeth, for esthetics, occlusal stability and functional harmony there must be a definite proportionality of tooth size. He proposed the inter-maxillary ratio to aid in determining disproportion in size between maxillary and mandibular teeth.

Anterior ratio is the percentage relationship of mandibular anterior teeth to maxillary anterior teeth (canine to canine) with a mean of 77.2 %. Overall ratio is the percentage relationship of mandibular teeth to maxillary teeth (first molar to first molar) with a mean of 91.3 %.

However in few instances as it could not be used in mixed dentition analysis and had to refer wheelers tooth size values in case of missing teeth posed few disadvantages.⁵

FACTORS AFFECTING THE BOLTONS TOOTH SIZE RATIO

Boltons discrepancy was considered to be significant only – 'If the discrepancy was more than boltons standard deviation 2.' Amongst the individuals with class I, Class II and Class III malocclusion, prevalence of Bolton's discrepancy was more seen in Class III.⁶⁻⁸

An individual tooth size variation as a peg lateral, malformed tooth, increase/decrease in labio-lingual or mesio-distal dimension is a common factor leading to Bolton's discrepancy. It was seen, almost 90 % of cases presented 0.25 mm tooth size discrepancy with the corresponding tooth in same or

opposite arch.⁹ Presence of maxillary anterior teeth, which are 18% to 36% larger than the mandibular anterior, presence of labial forces, tongue pressure and habit's presented with more of anterior Bolton's discrepancy compared to overall discrepancy in majority of cases. Amongst them, 19.7% had mandibular anterior excess and 10.8 % contributed to maxillary anterior excess.¹⁰ Though the overall ratio increases in a fairly proportionate manner as the anterior ratio increased, in most of the cases maxilla and mandible overall excess equaled.^{6,11}

Deep curve of spee, extreme labial inclination of incisor teeth, larger maxillary arch length [Figure-1] and crowding can also present with inter-arch discrepancy [Figure-2]. 'W Craig Shellhart' advocated use of boleys gauge for better correlations in measurements in crowded dentitions.^{12,13}

TREATMENT STRATEGY

Disharmony in tooth size can cause malocclusion. Mild discrepancies are most often difficult to locate during initial clinical examination. A treatment plan carried out without proper location of the area of discrepancy can just correct the malocclusion but will be difficult to achieve a proper intercuspation with normal overjet and overbite. Bolton's ratio is a mathematical calculation that can be easily carried out and is a better tool than a diagnostic set in localizing the area of discrepancy for treatment planning.

If the dentition were in state of malocclusion, and where treatment option would be non-extraction, it would be difficult to take decision whether to extract a dental unit or do proximal stripping to correct it. Without Bolton's ratio, a treatment can land up in excess space or space requirement to have proper inter-digitation.

Restoration of small teeth like peg laterals and reduction/addition in labio-lingual or mesiodistal dimension to attain its normal desired size aids in achieving normal boltons ratio [Figure-3]. In slight arch length discrepancy (less than 4.0 mm.) the amount of intercanine tooth material or in posterior segments could be reduced by interproximal stripping eliminating the need for the extraction of permanent teeth or inter canine width canine expansion.

In cases where anterior ratio is normal, will remain unchanged even if overall ratio is changed due to extractions of premolars. After premolar extraction a normal overall excess can present

¹Assistant Professor, Department of Prosthodontics, ²Associate Professor, ³Assistant Professor, ⁴Professor, Department of Orthodontics, Bharati Vidyapeeth Deemed University, Dental College and Hospital, Sangli, Maharashtra India.

Corresponding author: Dr. Sangamesh G. Fulari, Associate Professor, Department of Orthodontics, Bharati Vidyapeeth Deemed University Dental College and Hospital, Sangli, India

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Figure-1: Larger maxillary arch length can present with more Bolton's discrepancy



Figure-2: Presence of severe crowding in both arches. Bolton's ratio was less than 91.3% indicating maxillary tooth material excess.



Figure-3: Pre and Post Treatment - Restoration of peg laterals to attain its normal desired size aiding in correction of Bolton's discrepancy



Figure-4: Pre and post treatment - Extraction of one mandibular incisor in resolving mandibular anterior discrepancy

as small overall excess, while a high overall excess can come to normal. A discrepancy of apical base to the tooth material should be corrected by extraction or by other orthodontic procedures. If discrepancy exists between maxillary base to mandibular base, reduction of tooth material and/or expansion of the other arch is indicated and if crowding exists as a result of discrepancy in tooth size in maxillary to mandibular arches, reduction of tooth material in one arch or increasing in other arch can solve the discrepancy.¹⁴

1st and 2nd premolars vary in mesio distal size dimension.¹⁵ Premolars need to be considered on an individual basis before decision is made in extraction cases. In cases with overall and anterior maxillary excess, extraction of maxillary premolars, and in presence of overall and anterior mandibular excess,

extraction of maxillary and mandibular premolars can aid in resolving Bolton's discrepancy. Extraction of one mandibular incisor has also proved a valid option in resolving mandibular anterior discrepancy [Figure-4].

The amount of space occupied by the teeth in the arch is influenced by tip and torque of the tooth. Modifying tooth position by tip and torque can yield space. An Increase in the distal inclination (distal root tip) of upright upper anterior can increase the arch length up to 2mm and Increase in the lingual inclination (lingual root torque) of upright upper anterior can increase arch length by 1 mm.

Bearing the mesiodistal dimension of contralateral tooth and considering Bolton's ratio, prosthetic rehabilitation of missing tooth to be done for better stability.

In overall and anterior discrepancy, irrespective of amount and area of discrepancy present, aim should always be to achieve a ratio.

CONCLUSION

Relative harmony in the mesiodistal width of maxillary and mandibular teeth is a major factor in coordinating inter-digitation, overbite and overjet in centric occlusion. A significant variation in this can lead to occlusal disharmony. If this discrepancy goes undetected, may lead to embarrassing delays in the completion of the treatment at the finishing stages or compromised result. Assessing this proportionality, by a mathematical formula, Bolton's Analysis proves to be an important diagnostic tool.

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