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Case Report

Esthetic & conservative management of tooth size jaw size discrepancy

Ravindra D Rekhade¹, Vivek Agarwal¹, Anirban Bhattacharyya¹,
Gayatri Majumder¹, Suchetana Chakraborty¹, Suman Bhattacharya^{1*}

¹Haldia Institute of Dental Sciences and Research, Haldia, Purba Medinipur, West Bengal, India



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ABSTRACT

Optimal functional occlusion, overbite and overjet are the primary objectives of comprehensive orthodontic therapy. It may be difficult to achieve these objectives if the teeth of maxillary and mandibular arches are not in proportion. For an optimal result in the final phase of treatment, it's crucial to plan and precisely assess any differences in tooth size. This is because the maxillary and mandibular arches often do not match in size. The Bolton analysis, established in 1958, measures the mesiodistal widths of both upper and lower teeth to detect any discrepancies in tooth size. Addressing these disparities early on is key to managing them in a conservative manner. When it comes to conservatively managing a disparity in the size of the teeth and the jaw, laminate veneers are a great solution. This article demonstrates an interdisciplinary conservative approach in treating a patient with skeletal Class III malocclusion with a tooth and jaw size discrepancy.

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1. Introduction

The purpose of orthodontic therapy is to realign the bite so that the teeth are properly interdigitated and the overjet and overbite are corrected. The most common hinderance is the difference in the proportion of maxillary to mandibular tooth size, also known as the inter-arch tooth size disparity. Teeth alignment becomes extremely challenging, if not impossible, when the ratio of the maxillary arch to the mandibular arch is not proportional.

In case of mismatch between the maxillary and mandibular total tooth material, the result of orthodontic treatment is compromised and would lead to:

1.1. If excessive mesiodistal tooth material is present in the maxillary arch, there will be-

1. Increased overbite
2. Increased overjet
3. Crowding in the maxillary arch
4. Spacing in the mandibular arch
5. Linguoversion of upper incisors

1.2. If excessive mesiodistal tooth material is present in the mandibular arch there will be-

1. Reduced overbite
2. Reduced overjet
3. Crowding in the mandibular arch
4. Spacing in the maxillary arch
5. Labioversion of upper incisors
6. Linguoversion of lower incisors
7. Labioversion of lower incisors

* Corresponding author.

E-mail address: sumanbhattacharya887@gmail.com (S. Bhattacharya).

To achieve an optimal occlusion, the orthodontic "finishing" step, also known as occlusion detailing, involves complex biomechanical factors. Orthodontic alignment to achieve an optimal occlusion may not be feasible if the patient has a considerable Tooth Size Difference (TSD) between their maxillary and mandibular arches. Proper occlusion, including appropriate overjet and overbite, requires a proportionate size relationship between the maxillary and mandibular teeth. G.V Black in 1902 was among the pioneering researchers in the early 1900s who brought up the subject of tooth size. He measured a huge number of human teeth and created tables to record their mean size.¹ Following Black's investigation some authors have also studied TSD and co related with occlusion.²⁻⁵

Since its publication in 1958, Bolton's pioneering TSD research has served as the orthodontic community's de facto standard for clinically determining TSD. Bolton was the first to provide a straightforward and practically applicable approach for assessing TSD with his analysis. To help with treatment planning and determining the functional and aesthetic results of orthodontic patients, Bolton attempted to simplify the process of assessing tooth size.⁶

From 10 separate private clinics in the Seattle, Washington region, Bolton chose 55 cases that had exceptional occlusion. A comparison was made between the twelve mandibular teeth and the twelve maxillary teeth by measuring their mesiodistal dimensions from the first molar to the contralateral first molar in the same arch. Establishing a ratio of the anterior teeth of the upper and lower jaws followed the same procedure

Using a diagnostic setting, Bolton determined that these two ratios should be utilized for orthodontic diagnosis, providing the orthodontist with information into the cosmetic and functional results of the specific case. After taking the patient's upper and lower teeth' mesiodistal width measurements, the clinician might use this technique to compare the anterior and overall ratios to Bolton's published values, allowing them to access any discrepancies right away. It also shows any potential size disparity between the maxillary and mandibular arches. Bolton further broadened the usage of his findings in therapeutic settings. To find out if interdental stripping or tooth restorations are necessary, we employ Bolton's standard deviations from the original.⁷

Tooth size discrepancies are commonly concealed with resin composites. Unfortunately, the long-term aesthetic outcome is diminished by resin composites' susceptibility to staining, discoloration, wear, marginal leakage and fractures. Compared to porcelain-fused-to-metal or all porcelain full coverage restorations, porcelain veneers offer superior marginal integrity, longevity, and aesthetics. They are also highly compatible with soft tissues and can preserve more tooth structure. Full veneer crowns, which required lengthy preparation and ultimately endangered the tooth's life, were replaced with laminate veneers as a suitable

alternative in cases where esthetics has been the main concern.⁸

2. Case Report

A 28 years old male patient reported to the Department of Orthodontics and Dentofacial Orthopaedics with the chief complain of spacing in the upper front teeth region.

The patient presented with a Angle's Class I molar and Class I canine relation on both sides during the intraoral examination. There was a diastema measuring about 4.5 mm in the midline. The extraoral examination revealed a straight facial profile, a mesoprosopic facial form, and a mesocephalic shape of the head. Cephalometric evaluation showed a horizontal growth pattern, a Class III skeletal base, and a prognathic mandible. A mandibular tooth material surplus of 8.2 mm in the overall ratio and 4.26 mm in the anterior ratio were found by Bolton analysis. The patients' medical history did not contribute to the case. Intraoral and extraoral pictures were obtained for diagnostic purpose.

Diagnosis- Angle's Class I malocclusion based on a Class III skeletal base (Normal Maxilla & Prognathic Mandible) with proclined anteriors and upper anterior spacing.

2.1. Treatment objectives

1. To close the existing spaces
2. To achieve an ideal overjet and overbite
3. To correct the axial inclination of all teeth in both arches.
4. To maintain a Class I molar relationship
5. To maintain a Class I canine relationship
6. To achieve an aesthetic smile

2.2. Treatment progress

An informed consent was obtained from the patient before starting the treatment. The patient was strapped up with a pre-adjusted edgewise bracket (MBT) prescription. The initial levelling and alignment were done with 0.016 Heat activated NiTi wire, then proper wire sequence was followed as a routine protocol. The space distribution was started on a rigid stainless-steel wire. Elastic power chain and open coil springs were used for space distribution. The 4.5 mm of space was equally distributed in-between 12,11,21,22. Patient was then referred to the Department of Conservative Dentistry & Endodontics for further management."

Upon clinical examination in the Department of Conservative Dentistry & Endodontics, it was found that there was presence of spacing between 12, 11, 21, and 22. Diagnostic models were prepared utilizing the rubber base impression materials and type IV die stone. A diagnostic wax up was the first step in the treatment planning process. A shade was chosen using the Vitapan Classical shade guide (Vita Zahn Fabrik, Germany) prior to tooth preparation



Figure 1: Pre-treatment extra oral photographs



Figure 2: Pre-treatment intra oral photographs

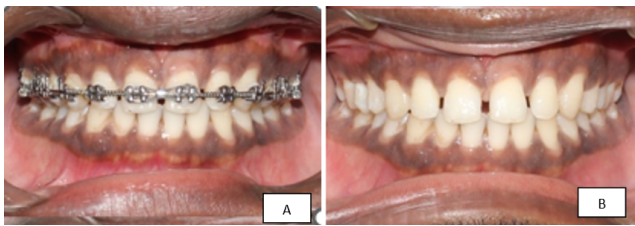


Figure 3: A: Space distribution mechanics by fixed orthodontic therapy; B: Post de-bonding photograph showing space distribution (12-22)

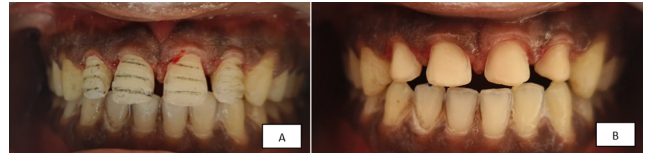


Figure 4: A: Three horizontal surface cuts were prepared in the labial surface with a friction grip three-tiered depth cutting diamond; B: Final tooth preparation for ceramic veneer



Figure 5: Intra oral scanning done after tooth preparation.



Figure 6: Emax maxillary veneers



Figure 7: Post-treatment intraoral photo graphs



Figure 8: Pre & post treatment frontal smile

on clear bright natural light. Teeth were prepared from the right lateral incisor to the left lateral incisor. Initially a friction grip three-tiered depth cutting diamond (DM 305, MANI INDIA) was used to make three horizontal surface cut on the labial surface which were 0.5mm deep in the enamel. Using the same bur, three incisal depth cuts resulted in a preparation one millimeter shorter than the final restoration's intended length. Labial reduction was performed in two planes using a tapered diamond bur with a rounded end (TR 13, MANI INDIA). The same bur was employed to extend the proximal borders discreetly into the contact area, and a consistent chamfer finish line of 0.5 mm depth was established. Additionally, the incisal edge was trimmed by 1mm to minimize the risk of fracture.

A modified butt joint extended to the inciso-palatal margin was crafted using a diamond wheel bur (WR 13, MANI INDIA). The tool was angled approximately 75 degrees to shape the labio-incisal-palatal angle. The palatal-incisal margin was kept sharp, whereas the labial-incisal margin was rounded. To minimize stress on the veneer margins, all internal angles were rounded. An intraoral scan was performed to capture a full arch impression, which was subsequently forwarded to the lab for the fabrication of IPS-Emax porcelain veneers. A temporary restoration was placed to emulate the final product

3. Veneer try- in and cementation

For the veneer fitting and bonding process, the temporary restoration was removed using an explorer, and the teeth were prepped with pumice and a prophylaxis brush for the trial.

The veneer's size, form, tint, fit, marginal adaptability and symmetry were checked and found to be acceptable. The aesthetic upgrade was appreciated during the group try-in that followed the individual evaluation. Cotton rolls and saliva ejector were used to isolate the teeth before

cementation. Each porcelain veneer had its intaglio surface etched with 9% Hydrofluoric acid (Waldent) for 20 seconds, after which it was sprayed with air and water for 30 seconds to ensure a complete washing. This was done to remove the residual byproducts which precipitate on the ceramic surface due to corrosion because of etching, which may jeopardize the bonding application of coupling agent. The porcelain veneer's etched intaglio surface was coated with a silane coupling agent called Monobond N (Ivoclar Vivadent, Liechtenstein), which was left on for 60 seconds before being gently dried with air.

At the same time, 37% phosphoric acid gel was used to etch onto the tooth surface for 15 seconds and then rinsed with water for 30-seconds. The surface was then blotted dry and dentin adhesive was applied and light cured for 20 seconds. After that, the intaglio surface of the veneer was coated with a mixture of base & catalyst paste of the dual cure resin cement Variolink (Ivoclar Vivadent, Liechtenstein). The veneer was then placed on the tooth and held under pressure with the help of OptraStick (Ivoclar Vivadent, Liechtenstein) and polymerized for 5 seconds. At this point any excess cement from the gingival margins and interproximal areas were removed. Then, they were light-cured for 40 seconds on each surface, specifically buccal, palatal/lingual and inter-proximal. The cementation started from the central incisors and gradually proceeded distally. Occlusion was checked and interferences, if any were adjusted. Instructions for proper oral hygiene and home care were provided to ensure the maintenance of the porcelain veneers. The restorations were evaluated under a stringent follow-up schedule after one week and again at three months to monitor their condition and quality.(Figures 1, 2, 3, 4, 5, 6, 7 and 8)

4. Discussion

The various treatment protocol available for diastema closure includes orthodontic approach, restorations using direct composite resin, indirect composite resins and ceramic veneers.

When one mandibular incisor is extracted, it is often possible to correct a Class I malocclusion that has a surplus of mandibular tooth material. There are usually three options for treating a mandibular excess—interproximal reduction, extraction, or restoration of the opposing arch. When the Bolton discrepancy is larger than 2.0 mm, it is common practice to extract one mandibular incisor. The choice to extract was not made with the goal of preserving the midline maintaining the Class I molar and the Class I canine relationship. In this instance, where the midline diastema exceeds 4.2 mm, (as assessed by the Bolton analysis), the aesthetics of the smile were enhanced by augmenting the upper arch with tooth material. We chose to use indirect ceramic veneers while explaining treatment options to a patient, it's important to outline

both the advantages and potential disadvantages of each choice. Evaluating anatomical details, bite alignment, and the expected aesthetic results can be effectively achieved through the examination of study cast models and a diagnostic wax-up. This approach ensures a comprehensive assessment and aids in achieving the desired treatment outcome. Because of their remarkable translucency and great aesthetics, these ceramics seem just like natural teeth. They are suitable for veneers that require little or no preparation because of their excellent aesthetics. The effectiveness of the treatment is greatly dependent on the bonding process that occurs between the veneer and the tooth.^{9,10} The good interdigitation of the posterior teeth confirmed the Class I molar and canine relation. The difference in jaw size between the top and lower teeth was effectively addressed.

5. Conclusion

When it comes to creating an optimal occlusion that is both functional and aesthetically pleasing, appropriate tooth size is a major factor. An effective orthodontic treatment plan can be developed by proactively addressing potential disparities prior to the commencement of treatment. This foresight ensures that the plan is both efficient and effective, tailored to the individual's unique needs. Crafting such a plan requires careful consideration of various factors to achieve the desired outcome. Achieve appropriate occlusion, it is helpful to use Bolton's analysis to measure TSD before orthodontic treatment begins. Additional research into the potential influences of incisor inclination, overjet and overbite on tooth size ratios is warranted. The patient expressed satisfaction with the outcomes in this instance. Ceramic veneers offer numerous benefits, including the need for little tooth preparation and the ability to attach ceramic to tooth structure, resulting in enhanced treatment quality.

6. Source of Funding

None.


7. Conflict of Interest

None.


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Author biography


Ravindra D Rekhade, Professor and HOD  <https://orcid.org/0000-0001-7235-0913>

Vivek Agarwal, Professor  <https://orcid.org/0000-0001-5914-7670>

Anirban Bhattacharyya, Professor and HOD  <https://orcid.org/0000-0003-0770-6500>

Gayatri Majumder, Assistant Professor  <https://orcid.org/0000-0002-4174-2882>

Suchetana Chakraborty, Post Graduate Trainee  <https://orcid.org/0009-0006-5389-3473>

Suman Bhattacharya, Post Graduate Trainee  <https://orcid.org/0009-0005-4512-6920>

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