

Contribution to the Study of Orthodontic Treatment for Concomitant Temporomandibular Joint and/or Orthognathic Surgery

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Abstract

Patients with dentoskeletal deformities might need a combined complex treatment involving Orthodontics and Orthognathics. A small number of those patients will express Temporomandibular Joint (TMJ) signs and symptoms of internal disease which has to be investigated through Magnetic Resonance Imaging (MRI) though. For optimal treatment results several details separated in many steps have to be addressed by the Orthodontist with help of the Oral and Maxillofacial Surgeon guiding the final aim of the presurgical orthodontic treatment. Clear and agreeable discussions are frequently necessary and all professionals involved must work as a team and not as independent authoritarians. Few orthodontic details and MRI investigations are described in this mini review by the authors hoping to contribute to the study of presurgical orthodontics for combined Orthognathics and TMJ surgeries.

Keywords: Orthodontic Treatment; Orthognathic Surgery; Magnetic Resonance Imaging; Maxillary Arch; Mandibular Arch

Abbreviations

TMJ: Temporomandibular Joint; MRI: Magnetic Resonance Imaging; BA: Bolton Analysis

Introduction

The sole intention of this paper is a singular and petite contribution to the already vast knowledge in Orthodontic treatment when it is focused on TMJ and Orthognathic surgeries. The article does not have the objective to put forward a bibliographic review and/or discuss in depth the aforementioned topics rather has its focus in minor details which Orthodontists and Surgeons have to keep in mind when treating patients with dentoskeletal deformities or facial malformations.

A proposed classification for recognition of medial and lateral dislocations of the articular disc is presented here, based on two lines, vertical and horizontal, which divide the condyle in the middle, superior-inferiorly and lateral-medially, when it is analyzed on MRI in coronal view.

Basic fundamentals

Several aspects are indispensable for professionals to consider when a mutual patient is seeking treatment for dentoskeletal deformities, which will culminate in combined orthodontics and orthognathic surgery. Some of these characteristics are numbered here but are not limited to:

1. Bolton's Discrepancy or BA has to be checked not only for 6-6 but for full arches. It is mandatory.

2. Not only arch coordination but format of the maxillary/mandibular arches and hemiarches are very important to obtain a proper and symmetrical occlusion.
3. Bands around ALL first and second maxillary/mandibular molars are still mandatory, once the posterior teeth guide condylar movements and seat both condyles properly. These teeth have to be in the right position prior surgery(ies).
4. Indirect brackets placement is a superior technique when compared to the direct one due to its gluing precision. Details make all the difference in orthodontics.
5. Maxillary arch should follow the Curve of Spee design as it eliminates interferences of the second molars for proper condyles seating during the postop follow-up and/or subsequent treatment. If maxillary second molars are extruded and/or this arch or even just one side (hemiarch) was flattened during pre-surgical orthodontics, a proper occlusion fitting and adequate intercuspatation of the whole maxilla or that specific leveled hemiarch will not be possible, resulting in inharmonious pressure on condyles. This discordant demand on TMJs might result in premature articular disc deformation and/or its displacement, condemning the conservative TMJ surgery previously performed along with orthognathics, resulting in relapse. If the TMJ procedure was a radical one, with total joint replacement, uni or bilateral, all moment and shearing forces will be borne by the screws fixating the fossa and/or the mandibular shaft components resulting in failure. So, patient's bone phenotype is an important facet of this kind of

treatment. Unstable occlusion along with material elevated stress, in this explicit case, will stimulate osteoclasts in the region to resorb bone around those screws, a devastating setback.

6. Mandibular arch should be totally flat from incisors to second molars. Watch out for 1NB angle increment when flattening this arch. In order to maintain this angle close to 20 degrees, mini-implants can be used for posterior teeth bone-born full anchorage or the Orthodontist can implement the, almost forgotten, Charles-Paul Tacail's effective technique.
7. Magnetic Resonance Imaging - MRI - for every patient with dentoskeletal deformities prior orthodontic treatment and TMJ/Orthognathic surgery(ies) is mandatory.

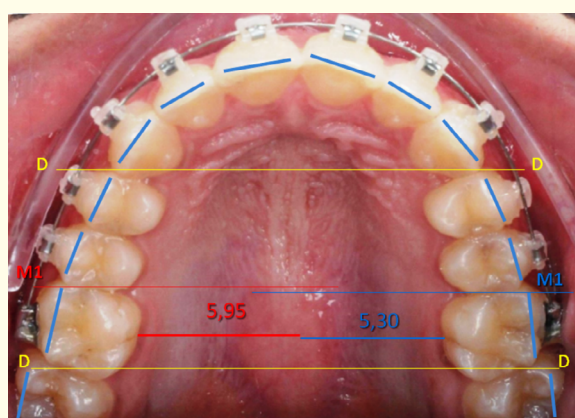


Figure 1. Occlusal view of the maxillary arch. Bolton's Discrepancy are marked in red, yellow and blue lines. D = distal. M = mesial. Red bold line: size of the right maxillary hemiarch. Blue bold line: size of the left maxillary hemiarch. Blue lines: represent the orientation of the incisal edges for evaluation of brackets mesial/distal placement.

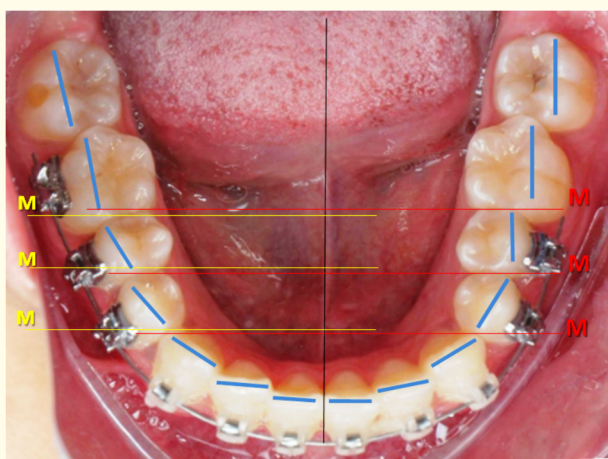


Figure 2. Occlusal view of the mandibular arch. Full mouth Bolton's Discrepancy represented in red and yellow lines. M = mesial. Absence of bands on molars are noticed. Blue lines: orientation of the incisal edges for evaluation of brackets mesial/distal placement.

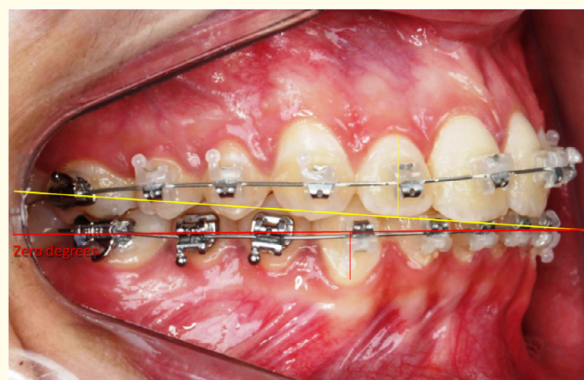


Figure 3. Occlusion view on the right side. Yellow line: maxillary occlusal plane follows Curve of Spee. Red line: maintain the mandibular occlusal plane, from incisors to molars, totally flat.

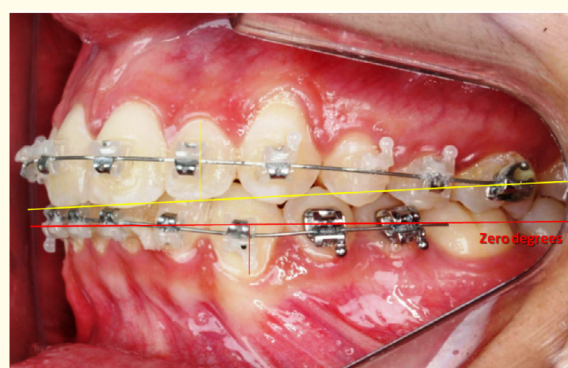


Figure 4. Occlusion view on left side. Yellow line: maxillary occlusal plane follows Curve of Spee. Red line: maintain the mandibular occlusal plane, from incisors to molars, totally flat.



Figure 5. MRI of the right TMJ on sagittal view. Blue arrow: significant intraarticular inferior space (inflammatory) effusion (The STIR - short time inversion recovery - sequence offers excellent visualization of the aqueous fraction in joints) is observed. Yellow arrows: demarcate the anterior and posterior limits of the right articular disc.

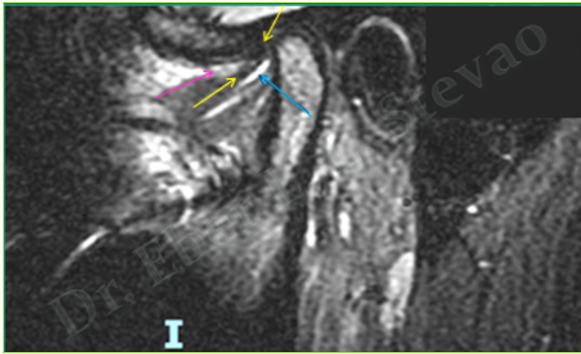


Figure 6. MRI of the right TMJ on sagittal view. This image only confirms the findings on figure 5. *Red arrow:* effusion present in the inferior articular space. *Yellow arrows:* anterior and posterior limits of the articular disc. *Magenta arrow:* discrete effusion inside the superior articular space on the right TMJ.

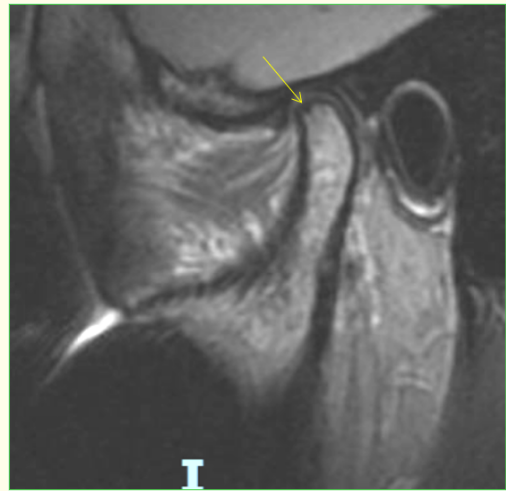


Figure 8. MRI of the right TMJ on sagittal view. Incipient alteration of the right condyle cartilage on its superior-anterior aspect. *Yellow arrow:* presence of subchondral cyst in the right condyle, a characteristic sign of developing osteoarthritis in the right TMJ.

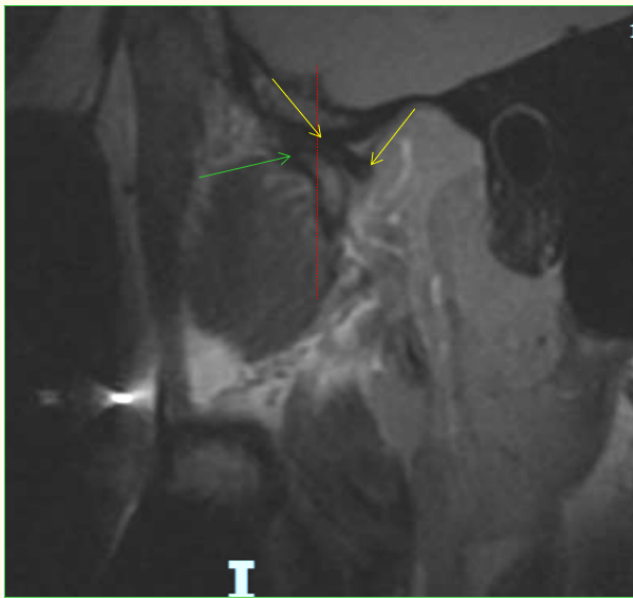


Figure 7. MRI of the right TMJ on sagittal view, opened mouth. Hyperexcursion of the right condyle passing the limits of articular disc and the most inferior aspect of the articular eminence is appreciated. *Yellow arrows:* anterior and posterior limits of the articular disc. *Green arrow:* anterior limit of the most anterior aspect of the right articular condyle. *Red arrow:* midline dividing the anterior and posterior limits of the articular eminence.



Figure 9. MRI of the right TMJ on sagittal view. Visualization of the Lateral Pterygoid muscle bundles on the right TMJ. *Yellow arrow:* superior Lateral Pterygoid muscle and its insertion on the articular disc and capsule. *Green arrow:* inferior Lateral Pterygoid muscle and its insertion on the articular condyle.

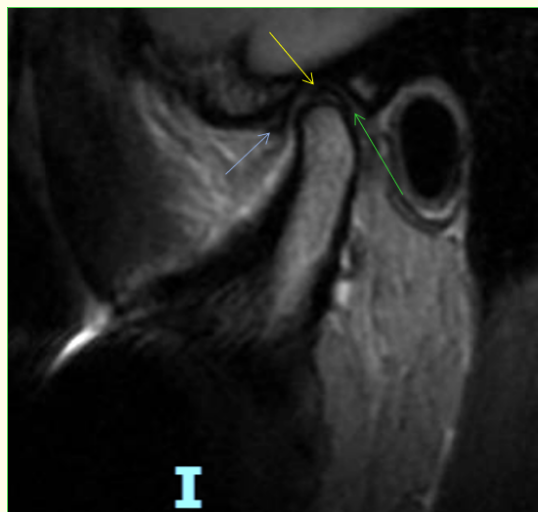


Figure 10. MRI of the right TMJ on sagittal view. Articular (adaptive) pseudo-disc on right TMJ is shown. *Yellow arrow:* anterior-superior limit of the pseudo-disc (adapted retrodiscal zone), due to an important anterior-medial articular disc displacement. *Green arrow:* posterior-inferior limit of the adaptative disc (pseudo-disc). *Blue arrow:* anterior band of the (real) articular disc.

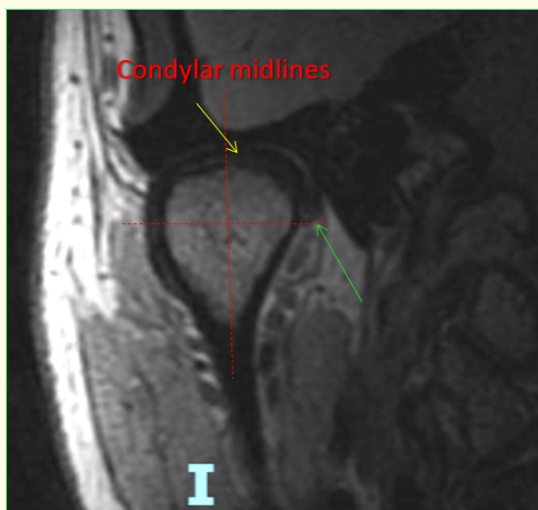


Figure 11. MRI of the right TMJ on coronal view. This image only confirms the findings on figure 10. *Yellow arrow:* superior limit of the articular disc on the right TMJ, severely/totally in medial displacement, crossing the vertical midline at twelve-hour mark. *Green arrow:* inferior limit of the articular disc, severely medially displaced, reaching the horizontal midline at three-hour mark.

Study-case illustration

Full mouth Bolton’s Discrepancy is performed and evaluation of brackets mesial/distal placement is appraised. Arches format and constriction of hemiarches is to be scrutinized and can be represented by the measurements found. In this patient studied here, the left hemimaxilla is more constricted when compared to the contralateral structure and it can be well observed on figure 1.

Discussion

Bolton Analysis (BA) is a tooth analysis used to determine the discrepancy between size of maxillary and mandibular teeth and it helps to determine the best possible interarch relationship. BA measures the mesio-distal width of each tooth. Normally orthodontists measure the mesio-distal width on the anterior upper and lower teeth only where teeth discrepancies happen more frequently. But in the case presented discrepant teeth sizes are observed on figure 1 and 2, not only on the maxillary and mandibular anterior teeth but also on the posterior ones, impeding the adequate and needed interarch relationship. The yellow and red lines never match up.

Molar bands help to adequately level and align posterior teeth giving and maintaining the correct format for the both arches mostly in the posterior region. In the case used for study here it is possible to identify a completely unsatisfactory positioning of maxillary and mandibular teeth. Patients who will be submitted to TMJ and/or orthognathic surgery(ies) demand an ideal presurgical teeth positioning avoiding postop major orthodontic adjustments which might impact the final best outcome.

MRI for TMJ evaluation for all patients undergoing TMJ and/or orthognathic surgery(ies) are mandatory, independently whether they assert or not on the first clinical examination: clicking, popping, discomfort, acute or chronic pain inside the joints.

The patient in this reported case referred clicking on the right TMJ when closing the mouth, associated with ipsilateral intermittent pain inside the joint, while the left TMJ is intact with the articular disc well positioned.

It is possible to appreciate right TMJ anterior articular disc dislocation on figure 5 and 6.

The right condyle is pushed way forward, passing the center (midline - vertical red line) of the articular eminence when

patient's mouth is opened, showing hypermobility and extended translation of the condyle on this side, well observed on figure 7.

Alteration of the normal right condylar cartilage is detected on figure 8, exhibiting signs of an incipient osteoarthritic condition.

Insertions of the Lateral Pterygoid muscle, in its two bundles, and possible alterations have to be evaluated in all sagittal slices of the TMJ MRI, as it is unmistakably monitored on figure 9.

Due to the anterior dislocation of the right TMJ articular disc, the ipsilateral bilaminar zone is modified into a pseudo-disc as seen on figure 10.

A more precise and simple classification for recognizing medial and lateral dislocations of the articular disc is presented here. It uses a TMJ MRI slice, on coronal view, which best represents the center of the condyle. Then two lines are drawn, one vertical and one horizontal, dividing the condyle in the middle. Nine, twelve, and three-hour positions are important marks which will represent minimal, moderate and severe (total) disc dislocations. Medial dislocation of the articular disc can be minimal when one third (1/3) of the disc has passed the twelve-hour mark - vertical line; moderate dislocation is found when two thirds (2/3) of the disc has passed the twelve-hour mark - vertical line; or severe/total when the whole articular disc is noted in the medial aspect of the condyle, touching the three-hour mark - horizontal line. For the lateral dislocation, the classification is the same but now based on the articular disc laterally positioned, between twelve and nine-hour mark. Based on this classification, a severe/total medial dislocation of the articular disc, on the right TMJ, is noticed on figure 11.

Final Considerations

Full knowledge and understanding of MRI interpretation and its clinical application is an obligation for both Orthodontist and Surgeon.

Inadequate orthodontics can misguide pre-surgical occlusion, hiding important details which will negatively impact the final result of both TMJ and Orthognathic surgeries, causing future relapse and compromising the whole treatment. In case of this undesired adversity happens, Orthodontist might end up accusing the Surgeon for treatment failure, who in his turn might affirm the pre-surgical orthodontic treatment was not correctly done. Just like in this case, the apparent good (undesired) occlusion obtained prior surgery is a total recipe for nonsuccess.

Conflict of Interest

The author of this article declare no financial interest and that

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