International Journal of Multidisciplinary Research and Growth Evaluation.

Dental Arch Asymmetry: What Considerations? For What Objectives? A Case Study

Rajae Elhaddaoui [1*], Hicham Benyahia [2], Fatima Zaoui [3]
[1] Assistant Professor, Department of Orthodontics and Dentofacial, Orthopedics Faculty of Dental Medicine, Mohammed V University in Rabat, Morocco
[2] Professor of Higher Education in Dentofacial Orthopedics, Faculty of Dental Medicine, Mohammed V University in Rabat, Morocco
[3] Head of Dentofacial Orthopedics Service and Professor of Higher Education in Dentofacial Orthopedics, Faculty of Dental Medicine, Mohammed V University in Rabat, Morocco
[2-3] Professor, Department of Orthodontics and Dentofacial, Orthopedics, Faculty of Dental Medicine, Mohammed V University in Rabat, Morocco

* Corresponding Author: **Rajae Elhaddaoui**

Article Info

ISSN (online): 2582-7138
Volume: 06
Issue: 01
January-February 2025
Received: 05-11-2024
Accepted: 06-12-2024
Page No: 78-83

Abstract
Dental arch asymmetry is defined as the deviation of incisor median from the median sagittal plane (MSP), the manifestations of which are exclusively dental and occlusal, without associated skeletal abnormalities.
The diagnosis of possible dental arch asymmetry requires an analysis of space by hemi-arch, which takes into account the asymmetric aspect of malocclusion and gives more realistic reflection of therapeutic goals. Indeed, this analysis makes it possible to highlight:

- requirement for different dental movements on the right and left.
- necessity for possible asymmetric extractions.
- imperatives of differential management of anchorage

This work illustrates the recommended approach for space analysis in a case of dental arch asymmetry. The objective was twofold: firstly, to demonstrate the importance of hemi-arch analysis in comparison to comprehensive assessment of space across the entire arch; and secondly, to define therapeutic goals indicated by this analysis, which are related to the position of lower incisor in the antero-posterior direction and correction of anterior and posterior asymmetries, and differential management of anchorage.

DOI: https://doi.org/10.54660/.IJMRGE.2025.6.1.78-83

Keywords: dental arch asymmetry, space analysis, hemi-arch, differential management of anchorage, asymmetric extractions

1. Introduction

Dental arch asymmetry is defined by the deviation of incisal midline from the median sagittal plane (MSP), without associated skeletal asymmetries [1-4]. Recommended approach in this case is based on a half-arch space analysis, which defines requirements and potential therapeutic methods (asymmetric extractions, differential management of anchorage, asymmetric mechanics…) [1, 2, 3, 5].

Case Presentation

The young patient, aged 20, had consulted within our department, wishing to undergo orthodontic treatment to align her teeth and harmonize her smile.

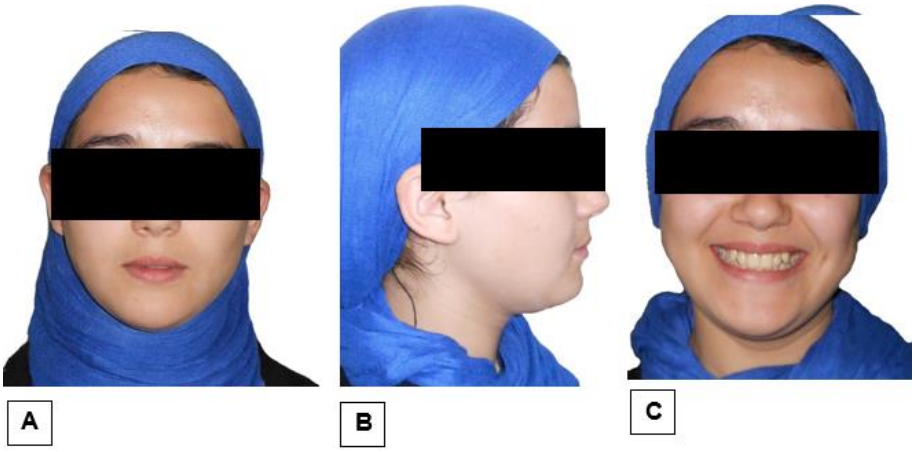

Fig 1: (a,b,c): Initial exobuccal photographs

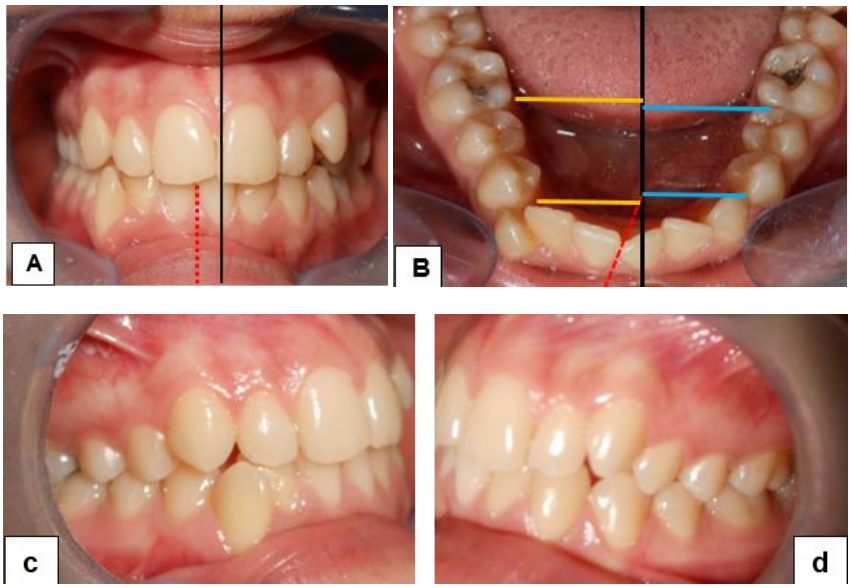

Fig 2: (a,b,c,d): Initial intraoral photographs

Exobuccal examination (Fig. 1) reveals a symmetrical face.
On intraoral examination (Fig.2 a,b,c,d) one can observe:

- Coincidence of upper incisal midline with facial midline.
- 3mm deviation of lower incisal midline towards the right side.
- Asymmetry in mandibular canines: 43 is ectopic.
- Asymmetry in mandibular molars: 36 is 2mm mesially positioned compared to 46.

Cephalometric analysis concludes the diagnosis of normodivergent skeletal class I, with palato-version of maxillary incisors and normo-chelia (Fig.3).

Fig 3: lateral teleradiography

Table 1: Cephalometric analysis at the beginning of treatment

FMIA	67°±3	65°
FMA	25°±3	27°
IMPA	88°±3	88°
SNA	82°±2	80°
SNB	80°±2	78°
ANB	2°±2	2°
AoBo	0±2mm	-1mm
I/NA	4mm+/-1 22°+/-2	4mm 18°
i/NB	4mm+/-1 25°+/-2	5mm 25°
Occ. plane	10°	10°
GoGn/SN	32+/-5	32
Angle Z	75°±5	77°
Post Facial Ht	45mm	45mm
Ant Faciale Ht	65mm	64mm
Index Post/Ant	0.69	0.70

Reflections

For space assessment, we chose, initially, to analyze the space over the entire arch according to Steiner [6], and then, in a second step, we conducted a half-arch analysis.

1. Total Space Analysis

Table 2: Total Space Analysis

	-	+
Crowding	8	
Curve of Spee	2	
Incisal repositioning	0	
Repositioning of first molars	-	-
Expansion	-	-
Subtotal	10	
Extraction		15

Total space assessment results in a subtotal or a value of dento-maxillary disharmony (DMD) of 10 mm, justifying the extraction of 2 mandibular premolars. The extraction space for two premolars in the arch is estimated at 15 mm, implying an estimated anchorage loss of 2.5 mm per half-arch (Table 1).

Furthermore, this analysis does not take into account the asymmetry of mandibular arch, i.e., deviation of incisal midpoint (3 mm to the right side) and canine retraction planned to resolve canine asymmetry, and remaining space allocated for symmetrization of mandibular molars.

2. Space Analysis by hemi-arch

The asymmetry of dental arch requires a reasoning and treatment plan by hemi-arch, regardless of the chosen cephalometric analysis and space analysis [1, 7, 8]. Crowding and depth of the curve of Spee must be evaluated on both hemi-arches. Only the incisal repositioning or cephalometric correction, except in exceptional cases, are identical on both sides [1, 6, 9, 10].

The chosen reference to restore symmetry of mandibular arch is the deviation of incisal midpoint from the MSP [1]. Correcting this midpoint deviation frees up space on the side of deviation, but on the contrary requires this space on the opposite side.

In the present case, we observe

- deviation of the incisor middle from the MSP by 3mm towards the right side (Fig. 2a,b).
- Crowding of 6mm on the right side (43 is ectopic) and 2mm on the left side (Fig. 2a,b).
- The depth of Spee's curve is 1mm in each hemi-arch.
- In this case, no incisal repositioning was planned (Tab.2)

Table 2: Analysis of each hemi-arch using Steiner's hemi-boxes

	Right side		**Left side**	
	+	-	+	-
Deviation of incisal midpoint	3			3
Crowding		6		2
Curve of Spee		1		1
Incisal repositioning		0		0
Subtotal		4		6
Extraction	7.5		7.5	
Molar displacement	3.5		1.5	
Canine retraction	4		6	

From this analysis using hemi-boxes, essential elements for treatment plan could be concluded, related to:

Magnitude of dental displacements: If we compare the magnitude of canine retraction, and in this case mesialization space of the two molars 46 and 36:

- The right canine (43) will be retracted by 4mm, leaving 3.5mm for mesialization of the right first molar (46).
- The left canine (33) will be retracted by 6mm, leaving 1.5mm for mesialization of the left first molar (36). (Tab.2).

Management of anchorage: It follows from the above that resolving asymmetry of mandibular arch necessitates differential management of anchorage: the right side allows for 3.5mm loss of anchorage, while anchorage management is more delicate on the left side.

Treatment

In order to simplify management of the case and achieve early correction of the deviation of mandibular incisal midpoint and the ectopia of 43, we opted for extraction of the first four premolars with differential anchorage management. For this purpose, we used a lingual arch to address anterior asymmetry first and we reserved molars anchorage loss (which was different between the right and left sides) for later stages (Fig. 4).

Fig 4: Mandibular incisal midpoint realignment with the MSP and posterior anchorage loss space

From the figure 4, we can deduce that after realigning mandibular incisal midpoint with the MSP, the amount of anchorage loss was consistent with that calculated from hemi-boxes space analysis: 3.5mm on the right side and 1.5mm on the left side (Table 2).

Treatment was completed by space closure and harmonization of inter-arch relationships.

At the end of treatment, fixed maxillary and mandibular retainers were placed (Fig. 5, 6).

The figure 7 illustrates post-treatment cephalometric analysis.

Fig 5: (a, b, c): Exobuccal photographs at the end of treatment

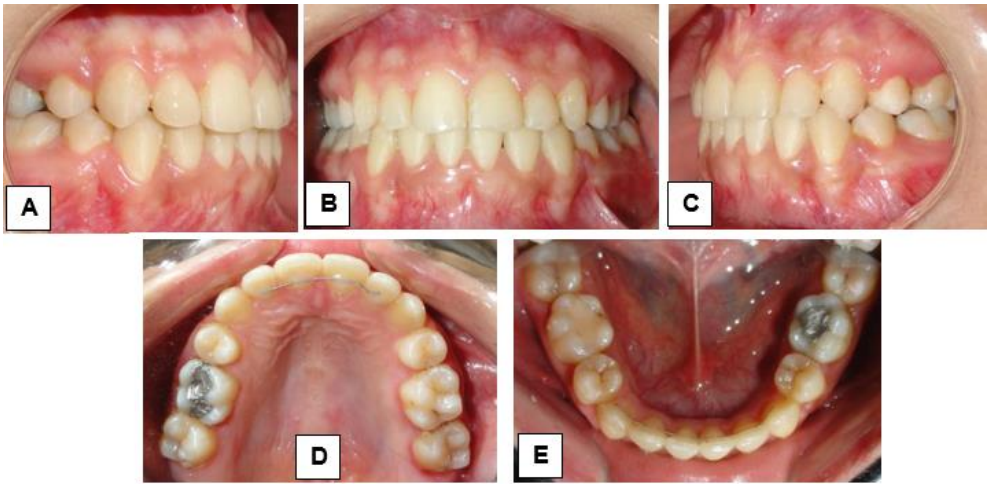

Fig 6 (a, b, c, d, e): Intraoral photographs at the end of treatment

Fig 7: lateral teleradiography

Table 3: post-treatment cephalometric analysisa

FMIA	67°±3	65°	67°
FMA	25°±3	27°	26°
IMPA	88°±3	88°	87°
SNA	82°±2	80°	80°
SNB	80°±2	78°	78°
ANB	2°±2	2°	2°
AoBo	0±2mm	-1mm	-1mm
I/NA	4mm+/-1 22°+/-2	4mm 18°	4mm 22°
i/NB	4mm+/-1 25°+/-2	5mm 25°	5mm 24°
Occ. plane	10°	10°	10°
GoGn/SN	32+/-5	32	31°
Angle Z	75°±5	77°	79
Post Facial Ht	45mm	45mm	45mm
Ant Facial Ht	65mm	64mm	64mm
Index Post/Ant	0.69	0.70	0.70

Discussion :

In absence of skeletal asymmetry, the aim of treatment of arch asymmetries is to restore concordance of incisor midlines with each other and with the MSP and a regularized and symmetrical arch shape, in harmony with skeletal bases, wich are themselves symmetrical [1, 3, 7].

Slight transverse asymmetries that do not lead to occlusal disturbances, as in this case, are corrected when the arch form is regularized during levelling phase [2, 7].

Sagittal asymmetries are corrected using multi-attachment technique, with asymmetrical management of tooth displacement and anchorage. Prior to any treatment, it is essential to determine the site of asymmetry: maxillary arch, mandibular arch or both. The symmetry of antagonistic arch must be respected where it exists, and parasitic effects of any inter-arch mechanics must be controlled [1, 3, 7].

To restore dental arch symmetry, the practitioner must distalize the teeth on the side where they are more mesial and/or mesialize the teeth on the opposite side, based on the possibilities and available space [1, 5, 9]. For this purpose, it was necessary to analyze two main parameters for the current case:

- analysis of mandibular arch, which is the site of asymmetry, is crucial. Indeed, the side with more mesial molar, known as the "short side," is the limiting factor in this type of treatment. This is the side where anchorage is most critical. Due to limited possibilities for mandibular molar distalization, symmetrization is mostly achieved through mesial drifting of the furthest distal molar. In other words, decision for extraction becomes necessary in the mandibular arch when distalization is not feasible [2, 5, 7, 9].

In the presented case, the deviation of incisal midline to the right side by 3 mm and asymmetry of canines due to the ectopia of 43 and asymmetry of molars were factors in favor of extraction in the mandibular arch with differential management of anchorage.

- The amount of canine retraction and consequently the degree of molar anchorage loss on each hemi-arch are determined through the analysis of space per hemi-arch.

This analysis is essential in cases of asymmetry as it enables prediction of the amount and direction of movement of canines and molars on each hemi-arch, along with means for achieving this differential management of anchorage [4, 5, 8-10].

Regarding our case, hemi-arch analysis indicated a molar anchorage loss of 3.5 mm on the right side and 1.5 mm on the left side in mandibular arch. This supported the extraction of the second premolar on the right side and the first premolar on the left side. However, several reasons justified the extraction of first premolars:

- ectopic position of tooth 43
- necessity for early correction of mandibular midline as recommended by Dougherty [4], which establishes a reference for other dental movements

- The existing Class I relationships of canines and molars before treatment, which also serve as a reference justifying extraction of first premolars

The sequence of recommended arch symmetrization varies among authors and also depends on the presence or absence of extractions in the treatment plan [4, 5, 8-10].
In this case, we first corrected anterior asymmetry by repositioning mandibular midline with the MSP, along with addressing canine asymmetry. Molars were retained using a lingual arch, and anchorage loss was made last. The figure 4 illustrates that actual anchorage loss was equal to that indicated by hemi-arch analysis (3.5 mm on the right side and 1.5 mm on the left side) (Table 2).
Asymmetric management of anchorage loss allowed for restoration of symmetry in lateral sectors. Anchorage of anterior sector was reinforced to prevent its displacement during mesialization of molars.

Conclusion

In presence of dental arch asymmetry, hemi-arch space analysis provides more realistic insight and more precise quantification of planned dental movements to symmetrize the anterior and posterior sectors, with prior visualization of anchorage management and correction of intra- and inter-arch relationships.

Conflict of Interest Statement: The authors declare that they have no conflicts of interest related to this article

References

1. Bardinet E, Baron P, Bazert C, *et al*. Orthodontic approach to asymmetry. Orthodontie Française. 2002;73:243-80. PMID: 12064070.
2. Bishara SE, Burkey PS, Kharouf JG. Dental and facial asymmetries: a review. Angle Orthodontist. 1994;64:89-98. https://doi.org/10.1043/0003-3219(1994)064<0089:DAFAAR>2.0.CO;2.
3. Deblock L, Ray B, Hueber V, *et al*. Les déviations des médianes incisives. Démarche Clinique. Revue d'Orthopédie Dento-Faciale. 1998;32:617-26. https://doi.org/10.1051/odf/1998023.
4. Dougherty HL. Asymmetrical treatment. USC Orthodontic Study Course of Europe. Syllabus. 1985;400 p.
5. Tarot Ph. Dissymétrie d'arcade: analyse de l'espace total, indications des extractions. Le Journal de l'Edgewise. 1995;31:91-104.
6. Steiner CC. The use of cephalometrics as an aid to planning and assessing orthodontic treatment. American Journal of Orthodontics. 1960;46:731-5. https://doi.org/10.1016/0002-9416(60)90145-7.
7. Burstone C. Diagnosis and treatment planning of patients with asymmetries. Seminars in Orthodontics. 1998;4:153-64. https://doi.org/10.1016/s1073-8746(98)80017-0.
8. Burstone C, Filleul MP, Pigeot V. Stability of orthodontic treatment of occlusal asymmetry. Orthodontie Française. 2000;71:197-205. PMID: 11039272.
9. Merrifield LL. Differential diagnosis with total space analysis. Journal of Charles H. Tweed International Foundation. 1978;6:10-5.
10. Tweed CH. Clinical Orthodontics. Mosby; 1966. 946 p.