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Case Series

Adult Orthodontic Treatment with or without Extraction: Report of Two Cases and Literature Review

Soukaina Sahim[1]*, Amal El Aouame[2] and Farid El Quars[3]

[1]*Resident, Orthodontics Department, Faculty of Dentistry, University Hassan II, Casablanca, Morocco*
[2]*Assistant Professor, Orthodontics Department, Faculty of Dentistry, University Hassan II, Casablanca, Morocco*
[3]*Professor, Orthodontics Department, Faculty of Dentistry, University Hassan II, Casablanca, Morocco*

***Corresponding Author:** Soukaina Sahim, Resident in Orthodontics Department, Faculty of Dentistry, University Hassan II, Casablanca, Morocco.

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Abstract

Treatment with or without extraction has always sparked a debate in orthodontics. With the new trends in orthodontic practice, extractions are less prescribed giving rise to more conservative treatments. However, neither non-extraction nor extraction treatment should be goals of treatment in themselves. This cases report discusses the two treatment options, their indications and their effects.

Keywords: *Adult Treatment; Orthodontics; Extraction; Non-Extraction; Outcomes*

Introduction

The debate over the extraction and non-extraction decision continues to be a contentious issue in orthodontics [1]. Today, after significant progress in orthodontic practice, similar arguments are being voiced between non-extraction expansionists and those who see the need for tooth extractions in some orthodontic patients [2].

Extraction is usually used in moderate-to-severe space discrepancies whereas non-extraction treatment is carried out in minor skeletal and moderate ones. The choice between extraction and non-extraction treatment is usually based on orthodontic diagnosis and treatment philosophy [3]. Different parameters must be taken into consideration such as the tooth arch- discrepancy, the skeletal discrepancies, the profile, the facial typology, the dental asymmetry and the dental prognosis.

In order to reach a final decision on the treatment's modality (extraction/non-extraction), several aspects such as stability of occlusion, characteristic of dental arches (widths, perimeters), the effects on the dentofacial complex and the effects on facial esthetics need to be considered [4]. In fact, treatment plan should be based on clinical features, model analysis, cephalometric readings, photographic analysis and soft tissue contours [5]. Hence, the clinician can evaluate which of the two treatment approaches may provide better outcomes.

Currently, the trend has changed to non-extraction approaches with more conservative treatment. However, there are some cases that can only be managed with extractions. Therefore, each case should be properly analyzed to make the right treatment decision.

Purpose of the Study

The purpose of this paper was to discuss, through two clinical cases, the criteria for choosing a treatment with or without extraction and to highlight the different effects of these two treatment modalities.

Case Report 1

A 35-year-old female was referred to the Department of Dento-facial Orthopedics of the Ibn Rochd University Hospital in Casablanca, Morocco, with a chief complaint of the overlap of upper and lower incisors. No significant medical and family histories were reported. She had a convex profile and an increased lower facial height (Figure 1A). Intraoral examination revealed crowding in the upper and lower incisors, an important overjet with incisor's protrusion, Class I canine relation on the right side, Class II canine relation on the left side and Class I molar relation on both sides (Figure 1B). Her skeletal and alveolar structures appeared to be normal in panoramic radiograph (Figure 7). Cephalometric analysis showed that the mandible was relatively retrusive to the maxilla, which led to a skeletal class II diagnosis (ANB = 7, AoBo = +4 mm). The patient had a skeletally long face (GoGn/SN = 42°, FMA = 33°). Moreover, both the upper and lower incisors were protruded (I/NA = 29°, i/NB = 47°, IMPA = 97°) (Table 1).

Figure 1: *(A) Pretreatment extraoral photographs. (a) Frontal at rest, (b) profile, (c) frontal smiling, (d) lateral smiling. (B) Pretreatment intraoral photographs. (a) Right lateral, (b) frontal, (c) left lateral, (d) maxillary occlusal, (e) mandibular occlusal.*

Treatment was planned with extraction of four first premolars to enable the correction of the protrusion and the crowding. Alignment and leveling was accomplished using 14 x 25" NiTi wires followed by 16 x 22" NiTi and 17 x 25" NiTi (Figure 2).

Figure 2: *Alignment and leveling.*

The correction of the denture was achieved by upper and lower incisors' retraction followed by setting up a Class I occlusion and a correct intercuspidation thanks to intermaxillary elastics traction (Figure 3).

Figure 3: *Correction of the denture.*

The finishing phase was carried out, then the device was removed. Upper and lower fixed retentions were put right after the device removal (Figure 4). Treatment was completed in 24 months.

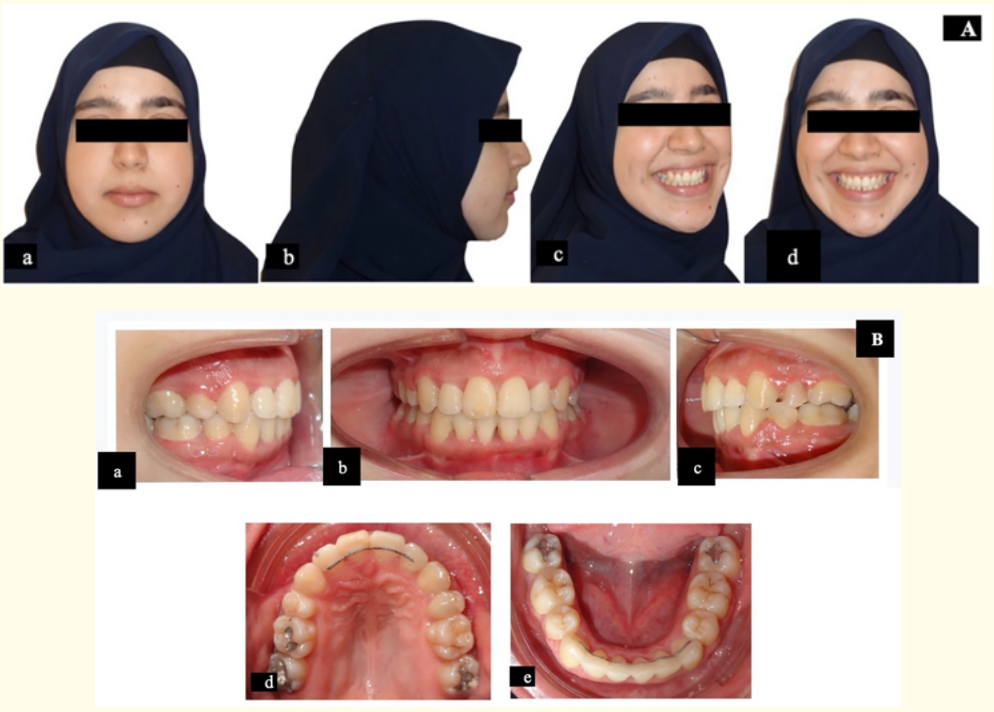

Figure 4: *(A) Posttreatment extraoral photographs. (a) Frontal at rest, (b) profile, (c) frontal smiling, (d) lateral smiling. (B) Posttreatment intraoral photographs. (a) Right lateral, (b) frontal, (c) left lateral, (d) maxillary occlusal, (e) mandibular occlusal.*

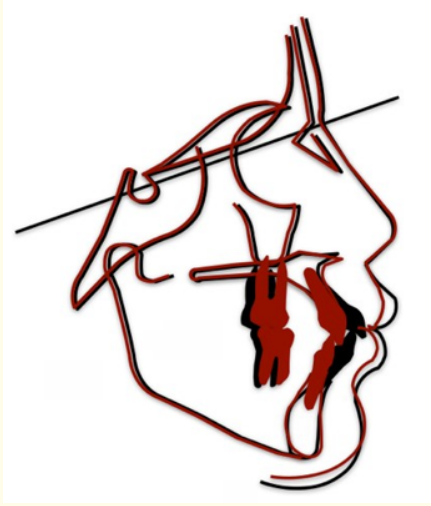

Figure 5: *Pretreatment and posttreatment superimposition.*

TTT		PRE-TTT	POST-
Variables	**Objective**		
SNA	82°	80°	75°
SNB	80°	73°	70°
ANB	2°	7°	3°
I/NA	22°	29°	19°
i/NB	25°	47°	30°
GoGn/SN	32°	42°	36°

TTT		PRE-TTT	POST-
Variables	**Objective**		
FMA	25° ± 3	33°	29°
FMIA	67° ± 3	50°	60°
IMPA	88° ± 3	97°	91°
AoBo	-2 mm - +2	4 mm	3 mm
Angle Z	75° ± 5	56°	70°
Index Post/ ant	0.69	0,50	0,58

Table 1: *Case 1-Cephalometric data.*

Facial esthetics were significantly improved. Extractions enabled the correction of the bimaxillary protrusion and the crowding (Figure 4 and 5). The treatment was stable with well settled occlusion and good esthetics (Figure 6 and 7).

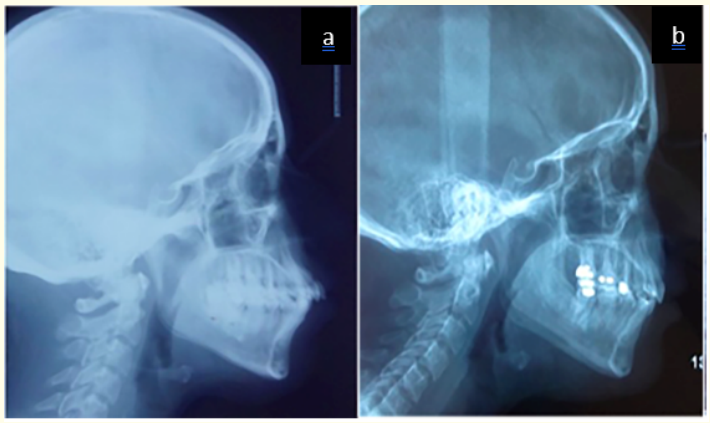

Figure 6: *Comparison of (a) pre and (b) posttreatment lateral cephalograms.*

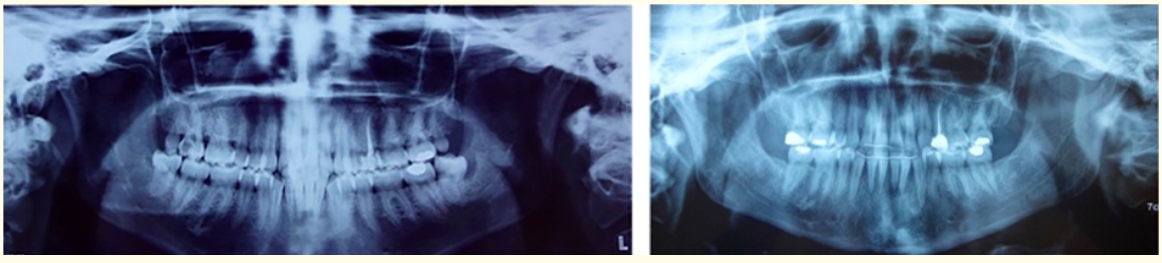

Figure 7: *Comparison of (a) pre and (b) posttreatment Panoramic radiographs.*

Case Report 2

A 34-year-old female was referred to the Department of Dento-facial Orthopedics of the Ibn Rochd University Hospital in Casablanca, Morocco, with a chief complaint of the overlap of upper incisors. She had a straight profile and a normal lower facial height (Figure 8A). Intraoral examination revealed moderate crowding especially in the upper arch, Class I canine and Class I molar relations on the right side and Class II canine and Class II molar relations on the left side (Figure 8B). Her skeletal and alveolar structures appeared to be normal in panoramic radiograph. The third mandibular molars had a distal angulation and the maxillary wisdom teeth were absent (Figure 14). Cephalometric analysis showed that the mandible was relatively retrusive to the maxilla, which led to a skeletal class II diagnosis (ANB = 5, AoBo = +4 mm). The patient had a normodivergent skeletal pattern (GoGn/SN = 30°, FMA = 28°). Moreover, the upper incisors were retroclined and lower incisors were proclined (I/NA = 20°, i/NB = 37°, IMPA = 100°) (Table 2).

Figure 8: *(A) Pretreatment extraoral photographs. (a) Frontal at rest, (b) profile, (c) lateral smiling. (B) Pretreatment intraoral photographs. (a) Right lateral, (b) frontal, (c) left lateral, (d) maxillary occlusal, (e) mandibular occlusal.*

The moderate crowding and the compromised profile have led us to plan the treatment without extraction of premolars with the use of expansion associated with an Air-Rotor Stripping ARS. The third mandibular molars were removed. Alignment and leveling was accomplished using 14 x 25" NiTi wires followed by 16 x 22" NiTi and 17 x 25 NiTi" (Figure 9). Following this step, the arches have been widened and thus the anterior overlaps have been corrected.

Figure 9: *Alignment and leveling.*

To reposition the maxillary incisors, Air-Rotor Stripping ARS has been carried out. The correction of the denture was achieved with 19 x 25 stainless steel wire and Class II elastics which lead to a Class I occlusion with a correct intercuspidation (Figure 10).

Figure 10: *Correction of the denture.*

The finishing phase was carried out, then the device was removed. Upper and lower fixed retentions were put right after the device removal (Figure 11). Treatment was completed in 17 months.

Figure 11: *(A) Posttreatment extraoral photographs. (a) Frontal at rest, (b) profile, (c) frontal smiling, (d) lateral smiling. (B) Posttreatment intraoral photographs. (a) Right lateral, (b) frontal, (c) left lateral, (d) maxillary occlusal, (e) mandibular occlusal.*

TTT		PRE-TTT	POST-
Variables	**Objective**		
SNA	82°	80°	79°
SNB	80°	75°	77°
ANB	2°	5°	3°
I/NA	22°	20°	18°
i/NB	25°	37°	34°
GoGn/SN	32°	30°	31°

TTT		PRE-TTT	POST-
Variables	**Objective**		
FMA	25° ± 3	28°	29°
FMIA	67° ± 3	51°	65°
IMPA	88° ± 3	100°	96°
AoBo	-2 mm - +2	4 mm	2 mm
Angle Z	75°±5	70°	78°
Index Post/ant	0.69	0,81	0,92

Table 2: *Case 2-Cephalometric data.*

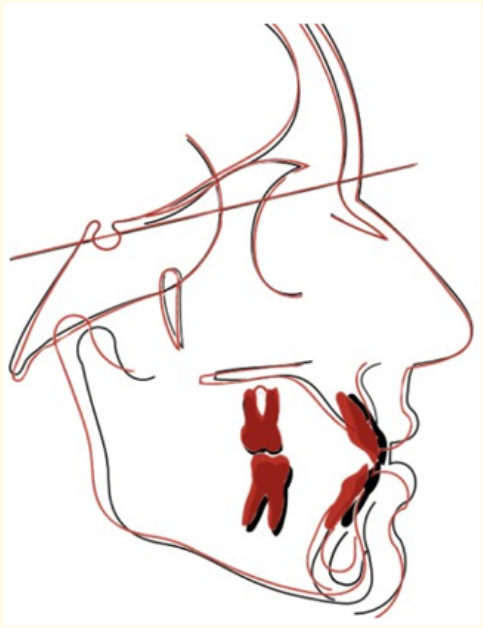

Figure 12: *Pretreatment and posttreatment superimposition.*

The treatment has responded to the patient's complaint without worsening the profile (Figure 12). It has also enabled a stable and well settled occlusion (Figure 13 and 14).

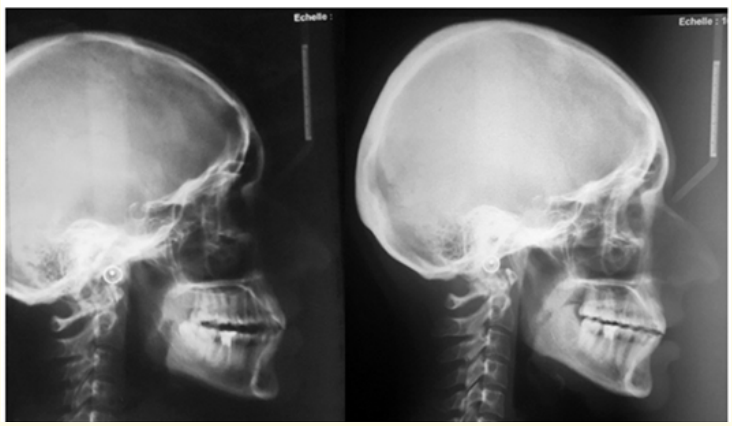

Figure 13: *Comparison of (a) pre and (b) posttreatment lateral cephalograms.*

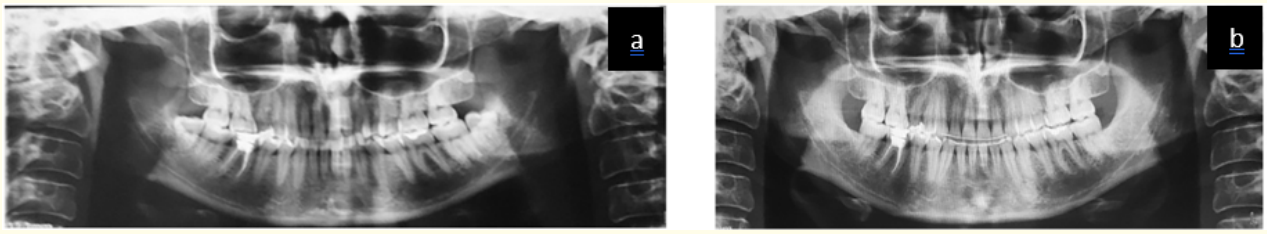

Figure 14: *Comparison of (a) pre and (b) posttreatment panoramic radiographs.*

Discussion

Treatment with extraction or without extraction is a dilemma for orthodontists especially in borderline cases [6]. Many factors influence the decision to extract (Table 3).

Criterion	Nonextraction	Borderline	Extraction
Vertical skeletal pattern	Deep bite		Open bite
Dental bite depth	Deep bite		Open bite
Procumbent lips or strained lip seal			X
Maxillary protrusive teeth/lips			X
Bidental protrusion			X
Crowding in a pleasing face	0-4mm	5-9mm	> 9mm
Combination of crowding and protrusion			X
Spacing	X		
IMPA			> 95°
Midline correction			X
Janson Type 1			Three premolars
Janson Type 2			One maxillary premolar
Retroclined teeth	X		
Class II or III camouflage		X	

Table 3: *General Guideline for non-extraction vs. extraction treatment [10].*

Extraction is usually indicated when there is a negative tooth arch- discrepancy (TAD) in the lower arch. According to Proffit and Fields, it is rarely required in TAD below 4 mm except in cases of incisor protrusion or posterior vertical discrepancy. When the TAD is between 5 mm and 9 mm, treatment can be performed with or without extractions depending on the characteristics of the patient and the orthodontic mechanotherapy used. And if the TAD is more than 10 mm, extraction is almost always required, preferably of first premolars because second premolar extraction is not suitable for large discrepancies [7].

The compensation of skeletal discrepancies may also require extractions to create sufficient space for incisor retraction or mesialization of buccal segment. Extraction can also be indicated when there is a pronounced labial tipping of the incisors with an important facial convexity. Patients presenting with severe dental midline deviation relative to the face (especially in the lower arch) require tooth extractions too [8]. Facial typology can also affect the decision for either extract or not. In hypodivergent patients, the extraction should

be avoided because it tends to worsen the vertical overlap and space closure is difficult. The quality and prognosis of the teeth may also influence the extraction decision. Heavily restored or carious teeth and teeth with periodontal involvement should generally be removed in preference to healthy teeth. Teeth of abnormal form or size are preferably removed as they look unsightly and can be difficult to align [9].

The measurements that lead to extractions are mainly the lower crowding, the lower lip to E-plane, the upper crowding, and the over-jet [11]. Bimaxillary protrusion is usually treated by the extraction of the first premolars [8]. In the case 1, the extraction has allowed the retraction of anterior teeth and the correction of the convex profile.

However, current tendency goes to treatment without extraction especially in cases with moderate crowding. Other factors encouraging a non-extraction treatment decision include air-rotor stripping (ARS), expansion, self-ligating brackets and preservation of leeway space [10]. In the case 2, the crowding was moderate and has been corrected through expansion and ARS.

The treatment without extraction can only be considered after taking into consideration four parameters: the dental crowding, the degree of incisor proclination, the impact on the face and profile and the periodontal consequences. The correction of crowding involves incisor protrusion and expansion of the dental arches, without clinically significant changes in hard and soft tissues of the face [12]. The periodontal status should be taken into consideration when protruding incisors especially in adult patients [13].

Many studies have discussed the effects of the treatment with or without extraction. These effects may concern the facial esthetics, the smile esthetics, the arch width, the control of vertical dimension, the outcomes and stability of treatment.

The esthetic effect of treatment on the facial profile depends of the type of treatment and the initial protrusion of the profile [14]. Extraction treatment improves facial aesthetics for many patients who present with some combination of crowding and protrusion [15]. Recent three-dimensional soft-tissue analyses following extraction treatment found that the greatest changes are seen in patients with the most protrusion [16]. In contrast, non-extraction treatment has little effect on facial aesthetics. However, the facial profile becomes more concave with age due to the growth changes especially mandibular and nasal development, and not influenced by whether teeth were removed or not [17]. Cases should, therefore, be preferably finished with slightly protruding profiles to prevent them from becoming concave in future [8].

Concerning the arch width, Kumari., *et al*. [1] found that there was an increase in intercanine width (1.9 mm) after extraction of first premolars due to the movement of the canines to a more posterior and wider place in the arch. Intermolar widths and arch depths decreased in both arches in the extraction group while the maxillary intermolar width increased in the non- extraction group. In contrast, according to Herzog., *et al*. [18], there was no significant difference in the maxillary and mandibular intercanine widths between the 2 treatment groups. Akyalcin., *et al*. [19] have also concluded that the extraction treatment did not result in narrower maxillary dental arches.

Concerning the smile esthetics, it has always been reported that the premolar extraction treatment shrinks the arches and unesthetic black triangles appear during smiling especially after 4 first-premolars extraction. However, a systematic review of Janson., *et al*. [20] concluded that neither four-premolar-extraction treatment nor non-extraction treatment has a predictable effect on smile esthetics, and that well-justified extractions have not impact on facial attractiveness. Isiksal., *et al*. [21] have also concluded that the esthetically compromising effect of narrow dental arches on smiles is not a systematic outcome of extraction treatment.

Many studies have evaluated the impact of extraction on the patient's vertical skeletal dimensions. According to Beit., *et al*. [22], class I patients treated with four first premolar extractions showed a slight decrease in the vertical skeletal measurements, whereas non- extraction patient treatment showed a slight increase. A systematic review by Kouvelis., *et al*. [23], corroborating the findings of Beit., *et al*. concluded that treatment with 4 premolar extractions has no specific effect on the skeletal vertical dimension. Thus, an extraction treatment protocol aiming to reduce or control the vertical dimension does not seem to be an evidence-based clinical approach.

Concerning the treatment outcomes, a non-extraction approach in cases with crowding and protrusion may not provide optimum esthetics, function, periodontal health, and stability [10]. Xu., *et al*. [24] found no statistically significant preferences of clinicians for tooth alignment, overbite, overjet, midline symmetry, or posterior occlusion in both extraction and non-extraction treatment.

Concerning the treatment stability, Guirro., *et al*. [25] have stated that changes in maxillary anterior alignment in Class I and Class II malocclusions treated with non-extractions and with extractions were similar in the long-term posttreatment period. Zafarmand., *et al*. [26] have also concluded that late incisor crowding was similar in both extraction and non-extraction groups. There is little evidence demonstrating the stability of expansion in non-extraction approach, particularly in the mandible. The risks of expansion are creating a dehiscence and worsening protrusion in an already convex face [10].

Conclusion

Trends have changed over the years in the decision of treating with or without extraction. Tooth crowding and protrusion often direct the clinician to choose a treatment with extraction. However, there is other criteria that may influence the decision of extraction such as the skeletal discrepancies, the profile, the facial typology, etc. The clinician must analyze each case and evaluate the potential effects of each treatment modality (with or without extraction) to choose the best approach which will provide the best outcomes for the patient.

Therefore, neither extraction nor non-extraction treatment should be goals of treatment in themselves. The good case selection with clear objectives and the careful treatment approach may provide the best outcomes for the patient and ensure the greatest stability.

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