Case Report

Interdisciplinary Treatment of an Adult Patient with Old Extraction Sites

Tülin Ugur Taner[a]; Derya Germec[b]; Nuray Er[c]; Ibrahim Tulunoglu[d]

Abstract: This case report describes the interdisciplinary treatment of a 31-year-old female patient showing a protrusive profile, maxillary constriction, mandibular crowding, a Class III canine relationship complicated with multiple missing teeth, old atrophic extraction sites, and periodontal defects. The lower dental arch irregularity was eliminated by air-rotor stripping (ARS). The upper extraction site was opened for prosthetic rehabilitation, whereas closure of the lower extraction space was preferred. The narrow alveolar crest of the atrophic bone was augmented with the use of autogenous bone, beta-tricalcium phosphate (Cerasorb®), and autogenous platelet-rich plasma. A functional and esthetic occlusion in an improved facial profile was established at the end of orthodontic treatment combined with ARS technique, surgery, and prosthodontics.

KEY WORDS: Air-rotor stripping; Interdisciplinary treatments; Adult; Atrophic extraction site; Augmentation; Space closure

INTRODUCTION

Adults presenting for comprehensive orthodontic therapy often have dental and periodontal problems that require multidisciplinary treatment approaches. Such problems include periodontal defects, missing teeth, and presence of old atrophic extraction sites.

In adults, closing an old extraction site with bone defects is likely to be a challenge for orthodontists. After several years following extraction, the remodeling of the bone produces a buccolingually narrowed alveolar process, and closure of the extraction spaces requires reshaping of the cortical bone.[1] Moreover, malocclusions in adults may be complicated by the migration of adjacent teeth into the old extraction sites. Under these circumstances, functional and esthetic results may only be achieved with the combination of surgery, orthodontics, and prosthodontic rehabilitation. It is known that almost 30% of adult orthodontic patients require multidisciplinary management to attain optimal treatment outcomes.[2]

Alveolar crest augmentation is usually required when inadequate bone width limits the orthodontic space closure.[3] Various bone grafting materials have been used in alveolar bone grafting procedures. These materials include autogenous bone (harvested from the iliac crest, rib, mandible or maxillary tuberosities), allogenic bone, and bone graft substitutes (eg, tricalcium phosphate and porous hydroxyapatite).[4,5] These grafts can be used alone or in combination with platelet-rich plasma (PRP) to enhance bone formation and increase the rate of bone graft healing.[5] The use of PRP is based on the premise that the large numbers of platelets in PRP release significant quantities of growth factors that may be promising for acceleration of bone regeneration.[5–7]

Comprehensive orthodontic therapy for adult patients should sometimes deal with controversial situations and include different treatment strategies. For example, in the presence of several missing teeth, solving anterior crowding requires other treatment alternatives than tooth extractions. Air-rotor stripping (ARS) has been proposed as an efficient and rapid treatment method for gaining dental arch length in adult cases.[8]

The aim of this case report was to present the interdisciplinary treatment of an adult case with periodontal problems, moderate lower anterior crowding, maxillary constriction, several extracted teeth, and old extraction spaces.

[a] Associate Professor, Department of Orthodontics, Hacettepe University Faculty of Dentistry, Ankara, Turkey.

[b] Research Assistant, Department of Orthodontics, Hacettepe University Faculty of Dentistry, Ankara, Turkey.

[c] Associate Professor, Department of Oral Surgery, Hacettepe University Faculty of Dentistry, Ankara, Turkey.

[d] Associate Professor, Department of Prosthodontics, Hacettepe University Faculty of Dentistry, Ankara, Turkey.

Corresponding author: Dr.Tülin Ugur Taner, Department of Orthodontics, Hacettepe University Faculty of Dentistry, Ankara, 06100 Turkey (e-mail: tulinortho@hotmail.com)

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Figure 1. (a–c) Pretreatment extraoral facial and lateral photographs.

CASE REPORT

Diagnosis and Etiology

A 31-year-old woman reported with a chief complaint of the esthetic appearance of her teeth and loss of function. Her medical history showed no contraindication to orthodontic therapy. Facial photographs showed protrusive lips and an unesthetic smile (Figure 1a through c). Intraoral examination revealed maxillary constriction, diastemata in the upper dental arch, 6 mm of crowding in the lower dental arch, a crossbite on the right segment and left maxillary first premolar site, an edge-to-edge incisor relationship on the left segment, and reduction of overbite. A Class III canine relationship was observed on the right side, and the lower dental midline was deviated to the left side. Her right upper second premolar, right lower first molar, left upper second premolar, and first molar were extracted and the left upper second molar mesially inclined into the extraction space. The right upper second premolar extraction space was completely closed by migration of the adjacent teeth. A knife-edge form of the bone in the lower extraction space was present (Figure 2a through e).

Radiological Examination

Evaluation of panoramic radiograph revealed a filling in the lower right third molar and moderate periodontal breakdown (Figure 3).

Cephalometric analysis showed that the lower facial height (ANS-Xi-Pm) and mandibular plane angle to FHP were increased to 52° and 32° respectively, indicating a dolichofacial pattern. The case exhibited a skeletal Class I relationship with the maxillary depth angle (88°) and facial depth angle (87°) within normal limits. The upper and lower incisors were both labially inclined and protruded (U1-APo angle = 30° and U1-Apo distance = 9 mm; L1-Apo angle = 24° and L1-Apo distance = 7 mm). The protrusion of the lower lip related to the esthetic plane was 0.5 mm (Figure 4).

Treatment Plan

Control of periodontal disease was required before orthodontic therapy could be started. The orthodontic treatment objectives were to close the lower extraction site, open the upper left extraction space for prosthetic rehabilitation, eliminate the maxillary constriction and crossbite, solve the mandibular anterior crowding with air-rotor stripping (ARS), and achieve good occlusal and esthetic results.

Treatment Progress

After the moderate periodontal disease was brought under control, a quad-helix appliance was used for maxillary expansion (Figure 5). Following expansion (Figure 6), the lower anterior dental arch crowding was solved with the ARS method. The tooth adjacent to the space gained by interproximal reduction of the posterior teeth was moved to the distal using open coil springs and an anterior Essix plate to reinforce anchorage (Figure 7). Meanwhile, Class III intermaxillary elastics were used to correct the Class III canine relationship. After an adequate amount of interproximal enamel reduction from the posterior teeth, the ARS technique was also applied in the anterior segment (Figure 8). The lower incisors were intruded with an intrusion base arch. The right lower extraction site was closed slightly during distal movement of the right lower premolars and canine. However, before complete

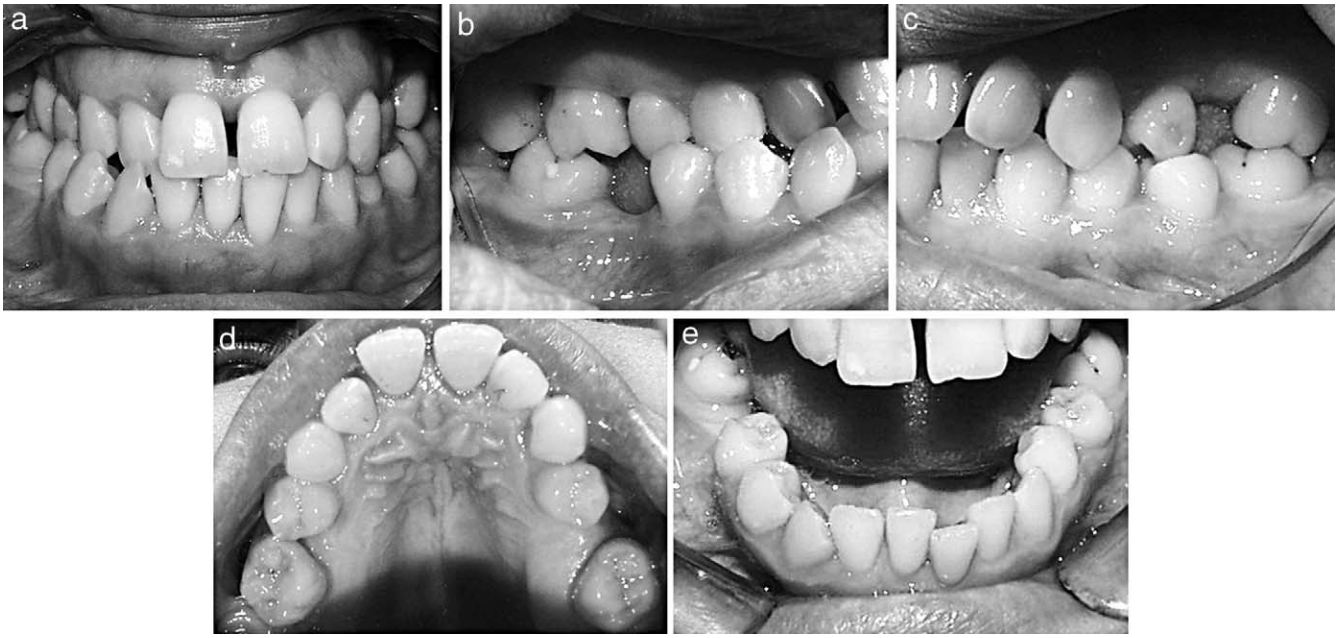

Figure 2. (a–e) Pretreatment intraoral photographs.

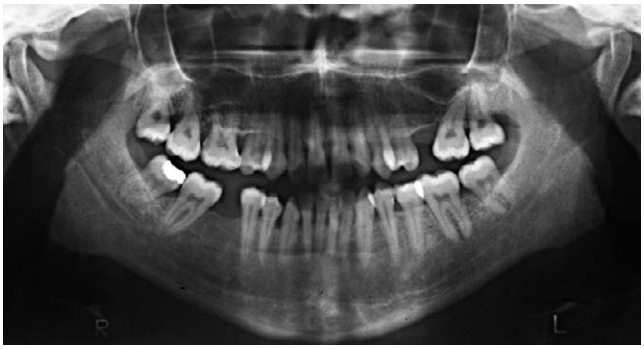

Figure 3. Pretreatment panoramic radiograph.

closure of the remaining lower right extraction space, surgical alveolar crest augmentation was planned to augment the inadequate buccolingual alveolar bone width.

Surgical Procedure

Under local anesthesia, the incision was made and a full thickness flap was elevated (Figure 9). The cortical bone was perforated with a round bur, and an onlay graft was placed with a combination of autogenous bone harvested from the maxillary tuberosity, beta-tricalcium phosphate (Cerasorb®, Curasan AG, Kleinostheim, Germany), and autogenous PRP (Figure 10). The flap was sutured to its original position with 4.0 silk sutures. Postoperatively, antibiotic, analgesic and antiseptic were given for 1 week after which the sutures were removed. The panoramic radiograph shows the augmentation area 1 month postoperatively

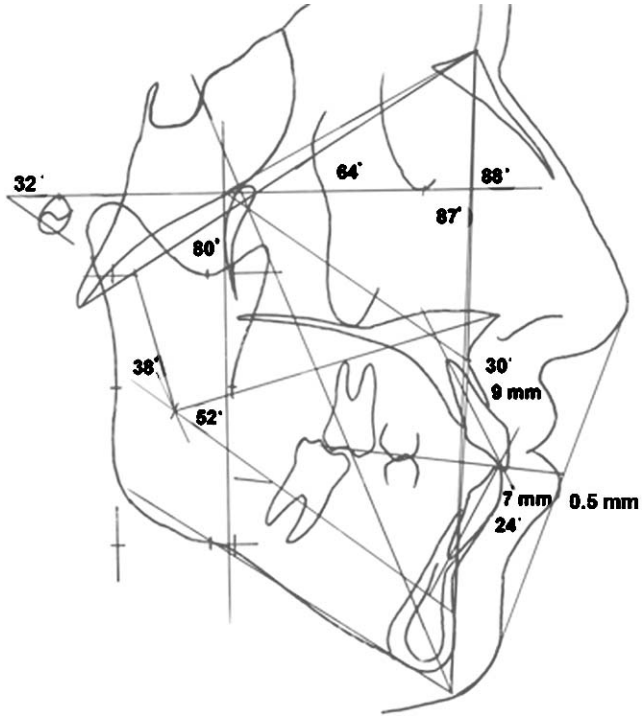

Figure 4. Pretreatment lateral cephalometric tracing and measurements.

(Figure 11). Three months after alveolar augmentation, tooth movement was initiated into the newly formed bone.

The upper extraction site was opened using a utility arch extending to the left upper third molar for distalization. Simultaneously, a push-coil spring was applied

Figure 5. Maxillary expansion with quad-helix appliance.

Figure 6. Intraoral view after maxillary expansion.

Figure 7. The use of open coil springs and anterior Essix plate following posterior ARS.

between the first premolar and molar teeth in combination with Class II elastics. After debonding, upper and lower Hawley retainers were placed for retention. A root form endosseous implant (Frialit-2, Dentsply-

Figure 8. Anterior ARS procedure.

Figure 9. The elevation of subperiosteal flap over the old atrophic alveolar crest.

Figure 10. Onlay grafting with autogenous bone, alloplastic graft material, and autogenous PRP.

Figure 11. Postoperative panoramic radiograph.

Friadent, Mannheim, Germany) was placed with a bone condensing method and after 3.5 months of osseointegration, the prosthetic rehabilitation was accomplished.

Treatment Results

At the end of 2.5 years of active orthodontic treatment, the facial profile appearance and the smile esthetic were improved (Figure 12a through c). A Class I canine relationship and normal overjet and overbite were obtained. The maxillary constriction, crossbites, mandibular anterior crowding, and lower dental midline shift were eliminated. The lower extraction space was completely closed without any detrimental effect on the periodontium such as gingival recession. The upper left extraction space was opened and an endosseous implant was used to replace the missing tooth (Figure 13a through e).

The panoramic radiograph showed parallel roots adjacent to the upper left and lower right extraction spaces (Figure 14a). Good alveolar bone height at the augmentation area can also be seen after space closure at the lower right area (Figure 14b). The cephalometric measurements at the end of treatment and the superimposition of the initial and final cephalometric tracings revealed an improvement in chin projection and the lower lip area. Lower incisor retraction decreased the lower lip protrusion. The bodily mesial movement of the lower right molar was also noted (Figure 15a,b). Satisfactory alveolar bone level was observed in panoramic and periapical radiographs taken 1 year after the termination of active orthodontic treatment (Figure 16a, b).

DISCUSSION

The old extraction sites of the present case were treated with an interdisciplinary approach including orthodontics, surgery, and prosthodontics. The orthodontic treatment of missing teeth comprises two different alternatives, ie, the closure and the opening of the extraction spaces. In the case of this patient, the decision of whether to open or close the extraction spaces was based on the age of the patient, the patient's periodontal status, the situation of extraction sites, the angulation of the adjacent teeth, and the patient's economic situation. Because the left upper second molar had drifted and inclined mesially into the old extraction site, the opening of this space to allow prosthetic rehabilitation was preferred. Because the proper root position allows for better periodontal health in adults,[9] the uprighting of the upper second molar in periodontally involved patients was selected as the appropriate treatment strategy. Because implants have become a reliable treatment alternative for the rehabilitation of edentulous sites,[10] implant-supported pros-

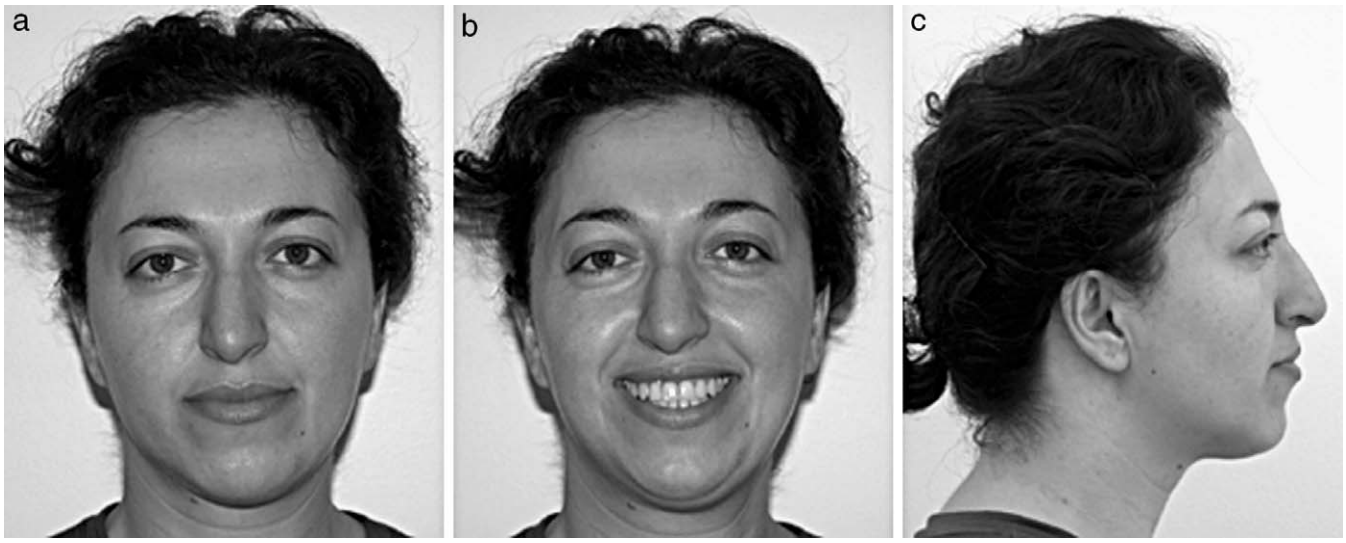

Figure 12. (a–c) Posttreatment extraoral photographs.

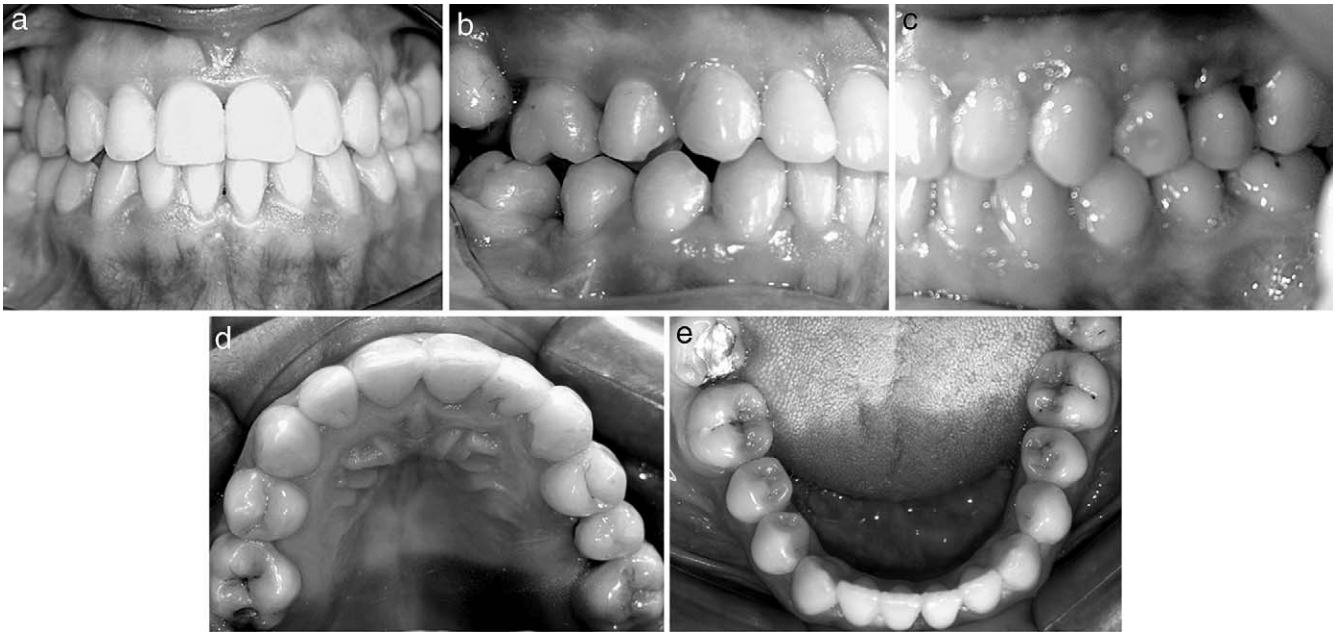

Figure 13. (a–e) Posttreatment intraoral photographs.

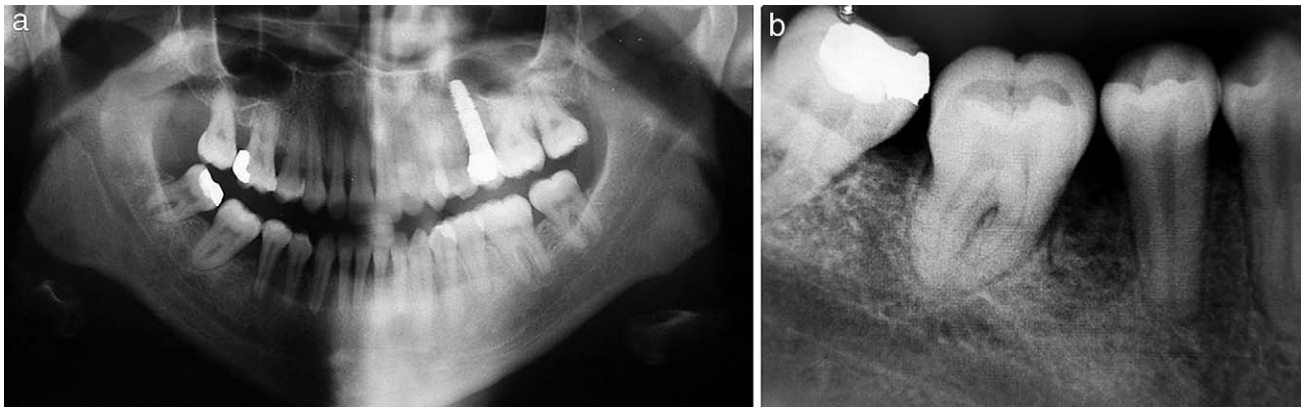

Figure 14. (a) Posttreatment panoramic radiograph. (b) Posttreatment periapical radiograph.

thetic rehabilitation was planned for the restoration of the opened extraction site.

On the other hand, it was decided to close the right lower extraction segment in order to eliminate the need of an additional implant and decrease the treatment expense. However, the alveolar bone width was narrow. It was assumed that if the buccolingual width of the alveolar crest is constricted, the second molar should not be moved mesially, because this will result in a loss of bone support.[11]

Furthermore, the problems of root parallelism, gingival dehiscence, and incomplete space closure are likely to occur. It was also shown that the adult patient resists the formation of any new bone during movement into a narrower edentulous space.[12] The ideal dimensions reported for a successful mandibular first molar space closure was reported to be 6 mm or less of mesiodistal space and 7 mm of buccolingual width.[13] In the present case, the mesiodistal dimension of the extraction space (7.5 mm) was greater and the buccolingual width (5.5 mm) was narrower. Thus, the uprighting and the bodily mesial movement of the lower molar into the old extraction space could not be achieved solely with space closure mechanics.

Complete closure of the extraction site without molar tipping was successfully achieved following alveolar crest augmentation by using a combination of autogenous and alloplastic graft material and PRP technique prior to orthodontic tooth movement. Although bone regeneration techniques have been widely used for orthodontic tooth movement into bone defects,[14–16] this case report was unique in demonstrating the closure of a first molar extraction space following bone regeneration with PRP combined graft technique. It

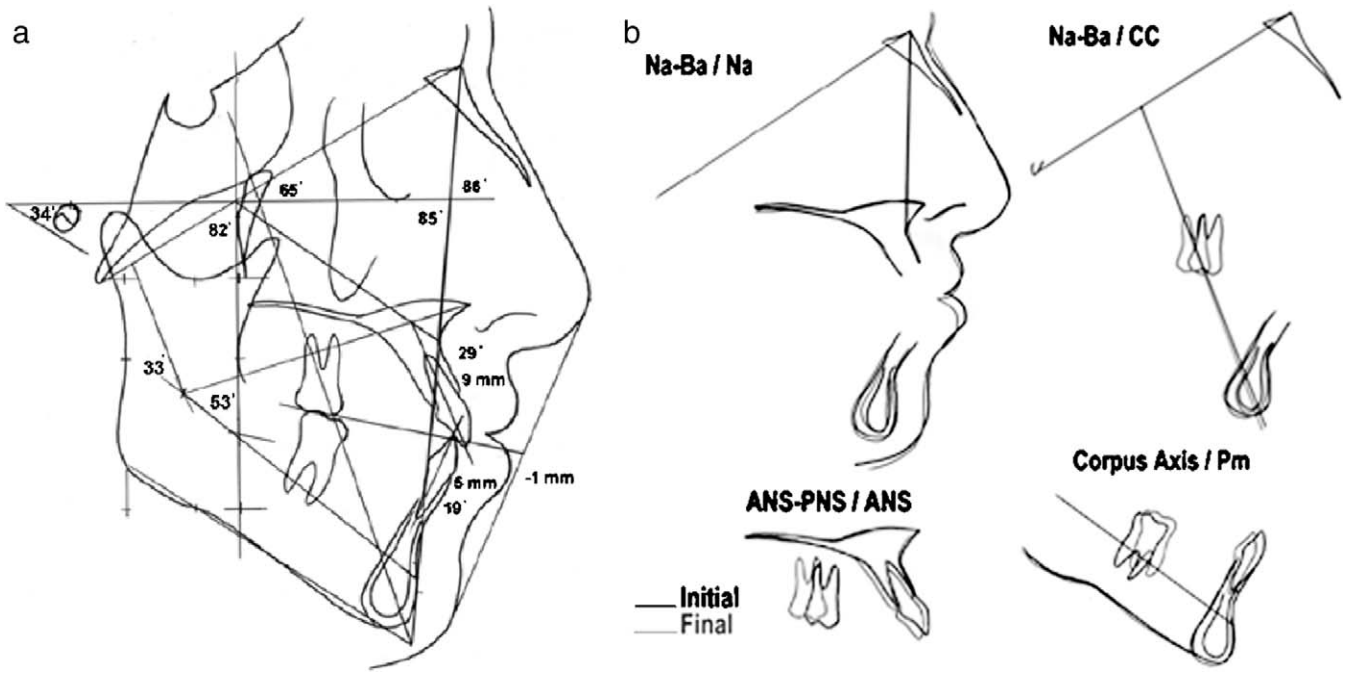

Figure 15. (a) Posttreatment lateral cephalometric tracing and measurements. (b) Superimposition of pretreatment and posttreatment cephalometric tracings.

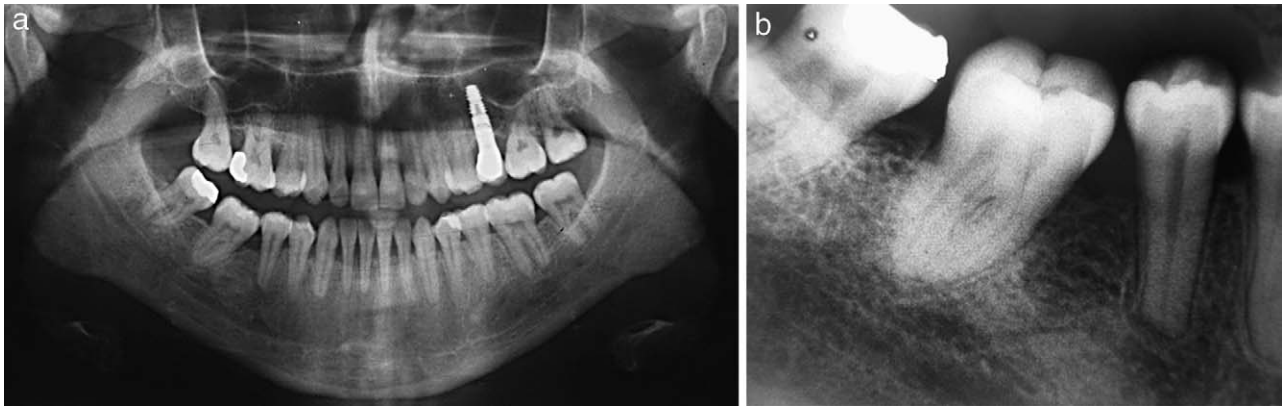

Figure 16. (a) Panoramic radiograph after 1 year posttreatment. (b) Periapical radiograph after 1 year posttreatment.

can be concluded that when extraction spaces are excessive, alveolar crest augmentation should be considered.

In this case, the ARS technique was used to solve mandibular irregularity and to obtain proper overjet and overbite. This method could be considered as the treatment of choice especially in adult patients with moderate crowding, because it helps to eliminate the undesirable effects of extraction therapy or unstable results of nonextraction treatment caused by overexpansion.[17,18] Moreover, it is known that posterior ARS significantly reduces treatment time.[19]

CONCLUSION

- Interdisciplinary treatment combining orthodontics with ARS technique, surgery, and prosthodontics helped to achieve good esthetic and functional results in an adult case with periodontal defects and multiple dental arch problems.
- Multicentral treatment approaches may provide alternative treatments to the more complicated procedures.

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