Long-term changes of the anterior palatal alveolar bone after treatment with bialveolar protrusion, evaluated with computed tomography

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This case report describes the treatment of a 31-year-old woman with a convex profile, protrusive maxilla, retrusive mandible, and gummy smile. Four premolars were extracted, and micro-implant anchorage was used to retract the anterior teeth. Lip protrusion and the gummy smile were improved, but the computed tomography images showed dehiscence on the palatal alveolar bone of the maxillary incisors. Approximately 10 years after treatment, significant alveolar bone apposition was seen on the palatal surface of the maxillary anterior teeth. (Am J Orthod Dentofacial Orthop 2018;153:108-17)

Lip protrusion is a common reason for Asian patients to seek orthodontic treatment.[1-5] To resolve this chief complaint, extraction of 4 premolars with maximum or absolute anchorage is usually required.

In conventional orthodontic treatment, such as the Tweed-Merrifield philosophy, patient cooperation in the use of a high-pull J-hook appliance is essential to obtain a satisfactory result.[6] But patients with thick soft tissues might find that the profile alteration or esthetic improvement produced is insufficient. Fortunately, skeletal anchorage, including micro-implants and miniplates, has been developed and used in a variety of ways in orthodontic treatment.[2,3,5,7] Micro-implant anchorage is an effective and beneficial technique for improving esthetics in patients with bialveolar protrusion, by retraction of the anterior teeth with simplified biomechanics. Moreover, absolute anchorage extends the limitation of tooth movements.

However, there is also an anatomic limitation in orthodontic treatment: the cortical plate of the alveolar bone. Therefore, excessive tooth movement results in tooth contact with the cortical plate of the alveolar bone, leading to alveolar bone loss and root resorption.[8-24] There is especially controversy over whether the anterior palatal bone has the remodeling capacity as shown in previous studies.[12-18]

To obtain objective data on the alteration of the alveolar bone during orthodontic treatment, lateral cephalograms have been most commonly used.[18-21] However, lateral cephalometry is the projection outcome on a 2-dimensional plane, which may result in inaccurate identification and imprecise measurement of the structure. In recent years, computed tomography (CT), which provides accurate data with fewer errors, has been used to evaluate structures of interest.[25,26]

The following case is regarding the treatment of a patient with bialveolar protrusion by retraction of anterior teeth using micro-implant anchorage and demonstrates the evaluation of remodeling on the anterior palatal bone using CT images during a retention period of approximately 10 years.

DIAGNOSIS AND ETIOLOGY

A 31-year-old woman had a convex profile with a protrusive maxilla, retrusive mandible, and gummy smile (Fig 1). As shown in the intraoral photographs, she had a Class II canine relationship, an overbite of 4 mm, an overjet of 5 mm, and mild crowding.

Cephalometric analysis showed a skeletal Class II relationship with an excessive maxilla and a retrognathic mandible (SNA, 85.1°; SNB, 78.2°; ANB, 6.9°), and a high mandibular plane angle (FMA, 30.4°). The maxillary incisors were tipped lingually, and the mandibular incisors were tipped labially (U1 to FH, 111.4°; IMPA, 103.7°) (Fig 2; Table).

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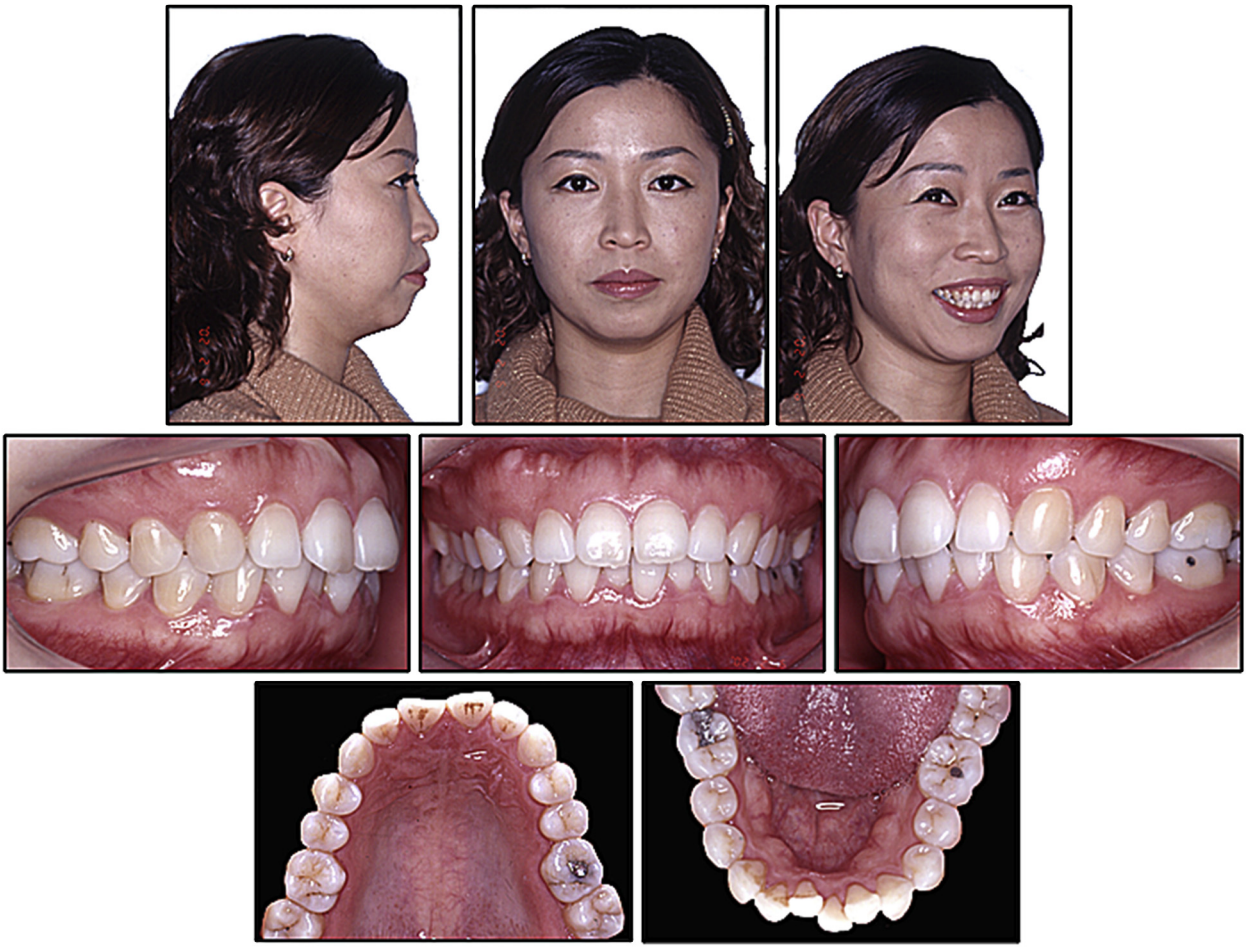

Fig 1. Pretreatment extraoral and intraoral photographs.

TREATMENT OBJECTIVES

The treatment objectives were to correct the lip protrusion, remove the gummy smile, and obtain a harmonious occlusal interdigitation for an esthetic profile and functional improvement.

For bodily movement of the maxillary incisors with uprighted inclination (U1 to FH=111.4°) and any amount of lip retraction, maximum anchorage in orthodontic treatment was required. Therefore, micro-implant anchorage should be used.

TREATMENT ALTERNATIVES

The following treatment options were established for the patient on the basis of the treatment objectives.

1. An anterior segmental osteotomy was 1 available treatment option to resolve the patient's chief complaint. An anterior segmental osteotomy with extraction of 4 first premolars can reduce the treatment period remarkably and achieve immediate improvement of facial profile.[4,27,28] In contrast, the dental and periodontal damage in the region of the osteotomy and the discrepancy between the anterior and posterior segments are negative consequences of segmental osteotomy.[29,30] However, the patient refused surgery and wanted orthodontic treatment only.
2. Orthodontic treatment with extraction of 4 premolars and micro-implant anchorage was proposed. Skeletal anchorage can enhance the amount of anterior tooth movement and provide simple biomechanics of orthodontic force.[2,3,5,7] Therefore, achieving a precise treatment goal and avoiding side effects during treatment were feasible. Furthermore, implications of surgery, such as an improper position of a segment, necrosis, and fracture, can be avoided. The patient chose this option.