

Case Report

The Interdisciplinary Management of Hypodontia: A Case Report

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Abstract

Severe hypodontia or oligodontia (≥ 6 congenitally missing teeth) is a rare condition but should not be neglected. It usually causes esthetic and oral function problems, and the treatments are complicated. Even though there are several options for treating hypodontia, a definite treatment plan should be carefully discussed and established by an interdisciplinary team consisting of clinicians of orthodontics, implantology, prosthodontics, and even pediatrics. This case report described the successful outcome of the interdisciplinary treatment of a 28-year-old female with severe hypodontia. We applied orthodontic tooth movement to increase the dimension of the edentulous ridge, and followed by implant placement. This approach can create more predictable bone volume than a ridge augmentation surgery procedure.

Keywords: congenital missing, hypodontia, interdisciplinary treatment, orthodontic tooth movement

Introduction

Congenitally missing teeth, also known as congenital absence of teeth, congenital dental aplasia, and tooth agenesis, is one of the most common human developmental anomalies¹. The prevalence of congenital teeth missing in adolescent Chinese populations with or without orthodontic treatment has been reported to be 6.39%, with congenitally missing teeth being more frequently found in females than in males to a statistically significant degree in both the treated and untreated groups². The definitions of hypodontia, oligodontia, and anodontia differ in terms of the number of missing teeth, on which there is no clear agreement¹. In most studies, however, the terms "oligodontia" and "severe hypodontia" are used to refer to the condition in which six or more permanent teeth, excluding third molars, are agenetic³, with the prevalence of oligodontia having been reported to be 0.14%^{4,5}. Besides an unfavorable appearance, patients with

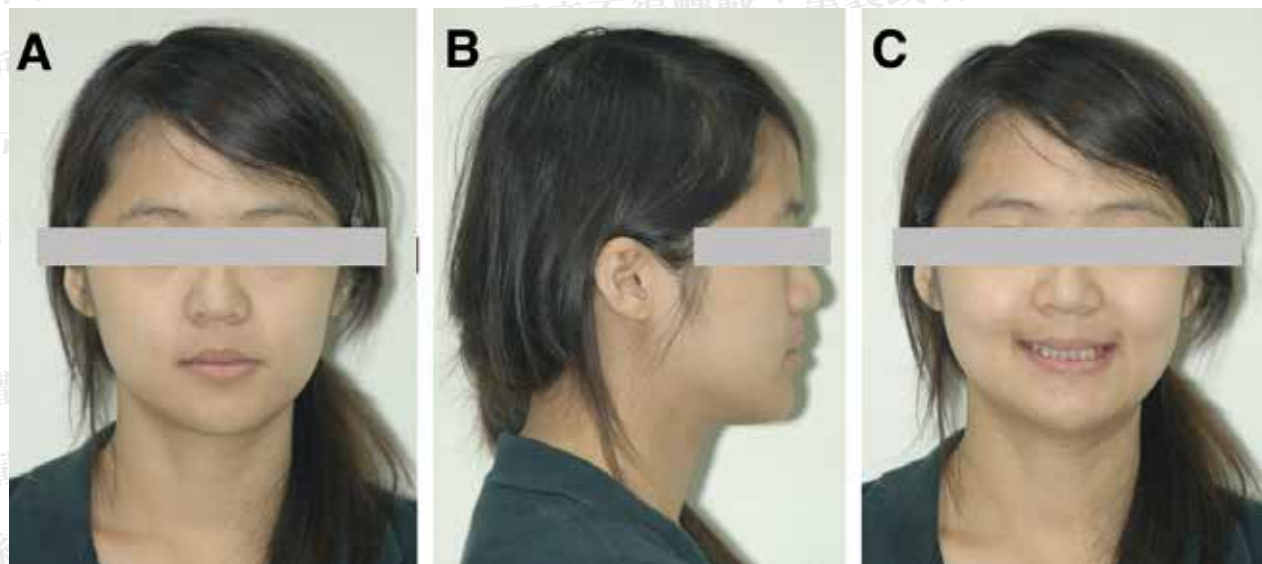


Fig. 1 Extra-oral view before treatment: (A) frontal view, (B) lateral view, (C) low smile line without showing upper teeth

severe hypodontia may suffer from malocclusion, periodontal damage, insufficient alveolar bone quantity, reduced chewing ability, and other problems¹.

The functional and psychosocial impacts of severe hypodontia are profound, and the restorative management of severe hypodontia is more complex than such management for non-hypodontia patients⁴. Generally speaking, the treatment of severe hypodontia is usually complicated, expensive, and interdisciplinary. To achieve an optimal outcome for a patient, counseling from clinicians specializing in several professional fields, such as orthodontics, prosthodontics, oral and maxillofacial surgery, and implantology, is indispensable during treatment planning^{5,6}.

Currently there is no standard treatment for hypodontia, but multiple modalities, including conventional fixed crowns or bridges, dental implants, and space re-distribution with orthodontic therapy, can be applied. Several factors, such as the positions of missing teeth, the bone quality of the edentulous ridge, the space available for restorations, the age of the patient, and the economic budget may influence the final decision regarding treatment. Filius et al. reviewed the survival rates of implants in hypodontia patients, reporting that they ranged from 35.7% to 98.7% (mean 93.7%)⁵. Creton et al.⁷ and Finnema et al.⁸ had different perspectives about the implant survival rate with the former stating that it may be affected by bone augmentation in the unfavourable anatomic ridge conditions and the latter reporting that implant loss was equally

distributed between bone graft-augmented sites and ungrafted sites. Undoubtedly, ample bone volume is essential for the successful osseointegration of dental implants.

In this case report, we present a case of full mouth rehabilitation of severe hypodontia accomplished through the cooperative efforts of orthodontic, implantology, and prosthodontic specialists. Furthermore, in order to place implants over the edentulous ridge, we used orthodontic tooth movement to increase the patient's bone volume.

Case report

A 24-year-old female came to the Department of Prosthodontics at Taipei Medical University Hospital with the chief complaints of an unpleasant appearance to her smile and impaired chewing function.

An extra-oral examination revealed an ovoid and symmetry frontal profile, along with a flat lateral profile. The nasolabial angle was within normal limits, and the lower lip was full. The patient had a low smile line and flat incisal curve (Fig.1).

The patient had an ill-fitted and dislodged 10-unit long-span bridge for the upper arch and a lower removable partial denture with fair oral hygiene and no caries (Fig.2). A radiographic examination revealed that 16 permanent teeth were congenitally missing (specifically, teeth 22, 31, 41, 36-38, 46, 47, 14, 15, 17, 18, 24, and 26-28) and the presence of a retained primary tooth (tooth 62) and an impacted tooth (tooth 48) (Fig.3). The width-length ratio and the proportions of the upper anterior teeth were



Fig. 2 Intra-oral views: (A) with and (B) without previous prosthesis

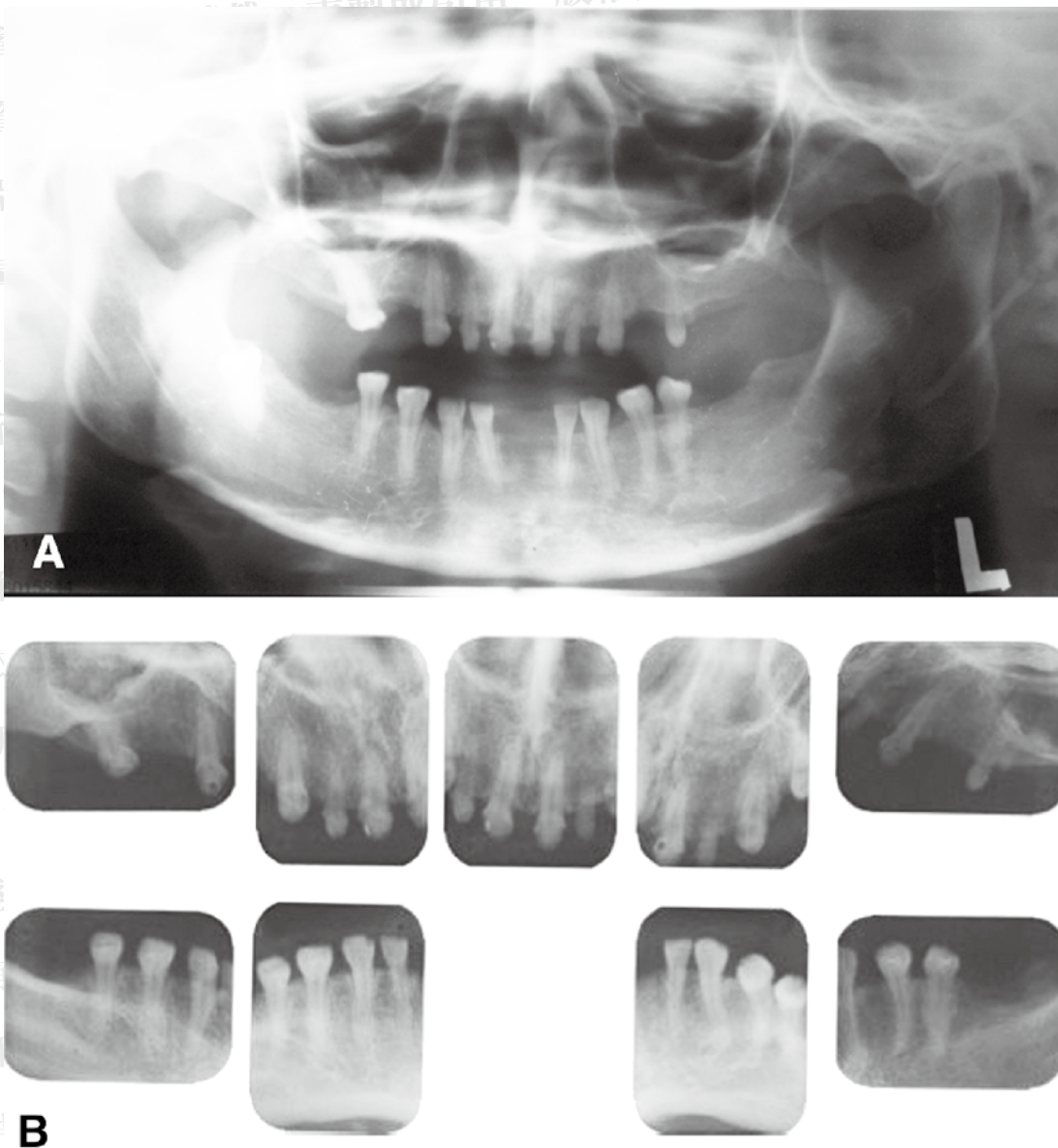


Fig. 3 The radiographic images before treatment: (A) panoramic film, (B) peri-apical films

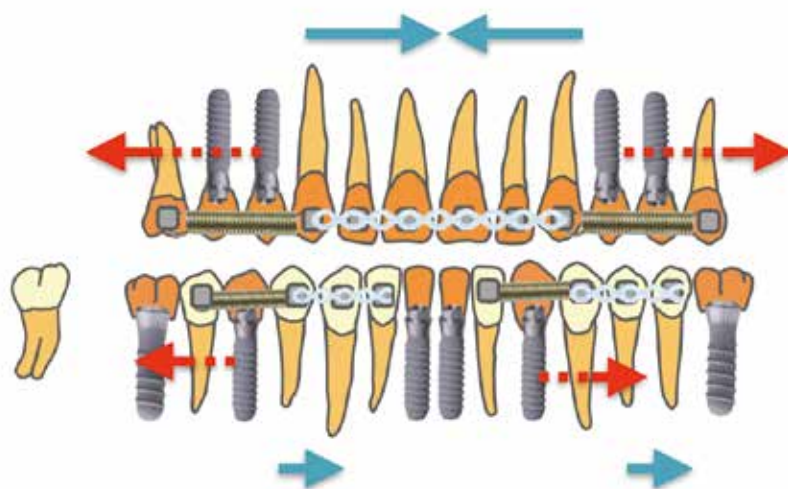


Fig. 4 Final treatment plan with redistribution of interdental spaces

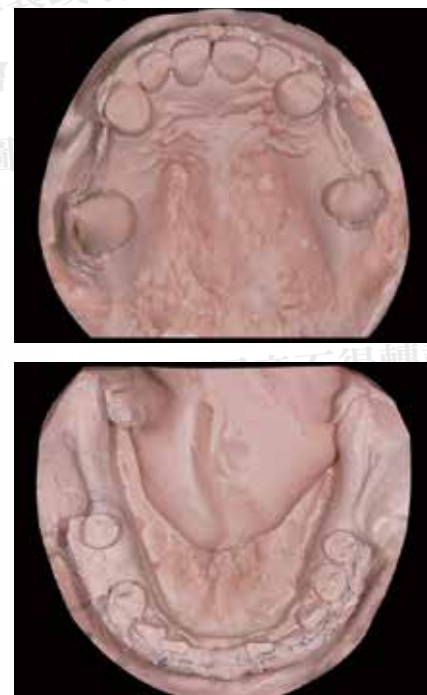


Fig. 5 Maxillary and mandibular stone casts showing the redistributed teeth after orthodontic management

not ideal and posterior occlusal support was poor with insufficient chewing function. Due to the patient's severe hypodontia, the edentulous alveolar ridge was severely resorbed both in height and width (Fig.2).

Based on the patient's expectations, the treatment goals were (1) to achieve an acceptable occlusion and establish posterior support, (2) to control and use the available spaces for the prosthesis, (3) to increase ridge dimension and height with bone augmentation for implant placement, and (4) to achieve an attractive smile and maintain a proper facial profile. Therefore, interdisciplinary treatment was conducted by a prosthodontist, an orthodontist, and oral surgeons, and the treatment plan included the following aspects: (1) orthodontic treatment to redistribute space; (2) ridge augmentation and implant placement over 14, 15, 24, 25, 33, 31, 37, 45 and 47 area. Full mouth space re-distribution, closure or open, planned by orthodontists; and (3) fixed prostheses for all teeth and implants except lower lateral incisors, canines, and premolars (Fig.4).

Pre-prosthetic orthodontic therapy

Before the orthodontic treatment, we remade all maxillary provisional crowns and

delivered lower new interim removable denture. On October 22, 2010, orthodontic appliances were bonded on maxillary provisional crowns to level the patient's tooth alignment and distalize the two second premolars. After five months, the mandibular teeth were also subjected to orthodontic treatment to distalize teeth 33 and 45 and close the diastema while maintaining anterior space. After one year and two months, the orthodontist created the space needed for the placement of implants in the 47, 45, 33, 37, 14, 15, 24, and 25 positions (Fig.5).

Ridge augmentation and implant placement

Before the placement of the implants, the surgeon scheduled a guided bone regeneration and sinus lifting surgery on the maxillary posterior area to increase the bone width and height on August 11, 2012. In the following month, one Ø3.3 mm implant with a 10 mm long narrow neck (Standard plus implant, SLA, Straumann®) was inserted into the site of the 45 position. Eight months after the ridge augmentation of the maxilla, three Ø 3.3 mm implants with 12 mm long narrow necks (Standard plus implant, SLA, Straumann®) were placed in the 14, 24, and 25 positions.



Fig. 6 Healing abutments were replaced with provisional restorations except tooth 33 implant. (A) intra-oral photos, (B) study casts



Fig.7 Final provisional stage. (A) With and without the transitional orthodontic retainer, (B) lips and teeth alignment during smiling

Due to the insufficient mesial-distal space of the upper right area, the orthodontist kept to distalize tooth 16 some more. Then, two weeks later, the surgeon placed one Ø3.3 mm implant with 10 mm long regular neck and one 3.3 mm implant with 8 mm long regular neck (Standard plus implant, SLA, Straumann®) in positions 36 and 47. During the same appointment, the guided bone regeneration of the tooth 33 area was also performed. The last two Ø3.3 mm implants with 10 mm long narrow necks (Standard plus implant, SLA, Straumann®) were finally inserted at positions 33 and 15 after six months of ridge augmentation. The ridge augmentation and placement of implants in positions 31 and 41 were postponed because patient got a job overseas, and the edentulous area would be restored by the interim removable denture.

Prosthetic therapy

During the period of osseointegration, we kept adjusting the lower denture and the provisional crowns, and progressively replaced the implant healing abutments with provisional restoration (Fig.6). When all the implants were stable and all the provisions were exhibiting good function and appearance, we de-bonded the orthodontic appliance and delivered the transitional retainers on April 8, 2015 (Fig.7). The final impressions were made for both arches for crown restoration of all the implant abutments and maxillary teeth. All the permanent crowns were fabricated using CAD-CAM zirconia except the four distal abutment restorations for positions 47, 36, 16, and 26, which were porcelain-fused-to-metal crowns with metal occlusion and underwent permanent cementation on June 12, 2015, after try-in and

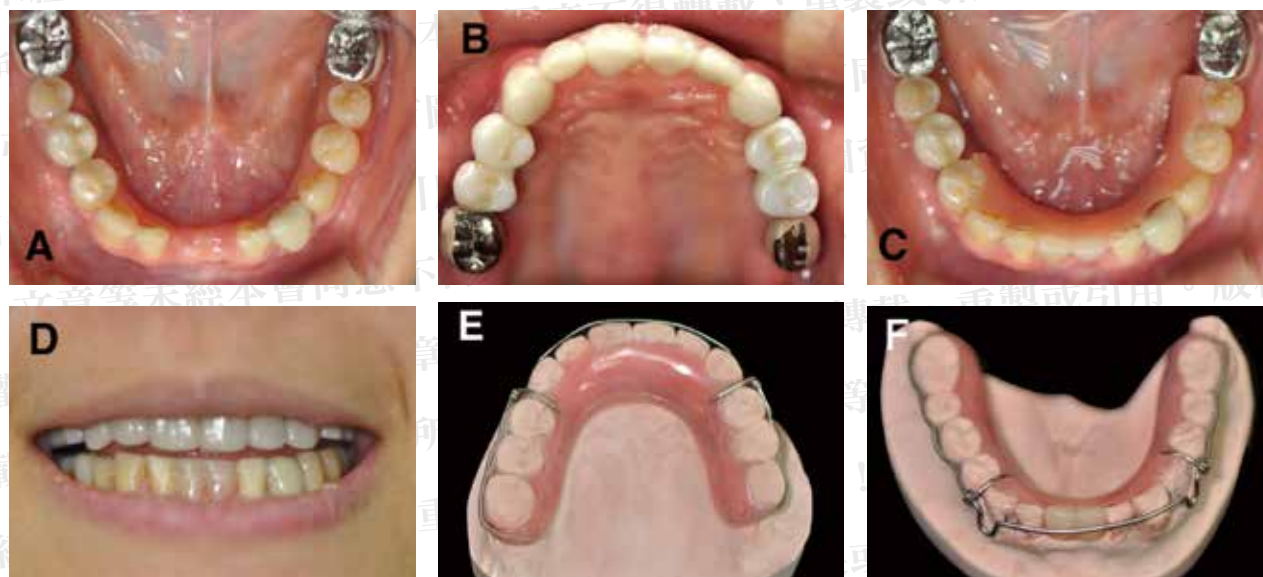


Fig. 8 The final prosthesis stage (A) maxillary occlusal view, (B) mandibular occlusal view, (C) occlusal view of mandible with removable partial denture, (D) smile view with permanent prosthesis, (E,F) final tooth alignment with orthodontic retainers

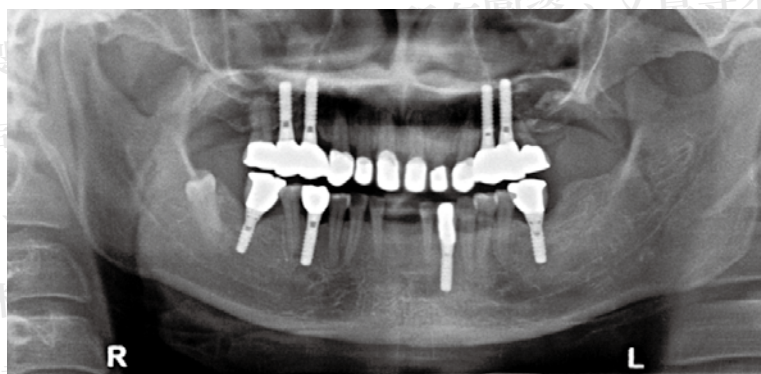


Fig. 9 The post-treatment panoramic film

occlusal adjustment. The orthodontic retainers and the interim removable partial denture of lower anterior teeth were then delivered (Fig.8). Finally, the patient was scheduled for a 6-month follow-up appointment (Fig.9).

Discussion

Severe hypodontia (≥ 6 missing teeth) is usually associated with esthetic and functional problems, and the treatment may also be expensive and interdisciplinary in nature⁵. When the treatment plan includes orthodontic treatment to create or redistribute the space required for later rehabilitation, which means that the treatment process will take a relatively long amount of time. Due to the congenital absence of teeth in the case presented herein, the amount of available bone in the edentulous

area was extremely insufficient and posed a great challenge in terms of implant placement. We spent approximately two years achieving an adequate bone volume and the osseointegration of the implants.

Even though the technique of guided bone regeneration for ridge augmentation has been well studied and thoroughly reported, it may nonetheless require two or more surgeries to create adequate ridge dimensions. Some experimental studies and case series have revealed that the indications for orthodontic treatment were space closure or opening due to lack of adequate space for prosthetic reconstructions, in addition to finding that an increase of the width of the alveolar ridge followed tooth movement into an area of reduced ridge dimensions, even though some reduction in

the width was seen in the area from which the tooth was moved⁹⁻¹². These findings suggest the possibility of combining both treatments, orthodontic tooth movement and guided bone regeneration, to make our case more predictable instead of doing the ridge augmentation surgery only. However, there were some noteworthy complications, such as lateral root resorptions, which were found on the pressure side of all the orthodontically moved teeth. But in most of the past case reports, no signs of further resorptions were observed after termination of the active tooth movement¹². In our case, the most pronounced lateral resorption was found at the upper left distal abutment, which moved the greatest distance and was subjected to the longest treatment duration.

Notwithstanding the generally high survival and success rate of implants, the failure rate in severe hypodontia is higher than in non-compromised subjects, an issue which seems to be mainly associated with the location, the bone volume, and the need for augmentation. Peri-implant bone loss, peri-implant mucositis, and peri-implantitis have not been well assessed in severe hypodontia patients, and long-term (>10 years) results are also lacking⁵. However, we still can not deny the fact that treatment with dental implants is promising and advantageous to patients. We placed a total of eight implants, four in the maxilla and four in the mandible, to establish a proper and sufficient occlusion.

Despite the reliability of metal being better than that of ceramic, we used zirconia as the restorative material for the fixed prosthesis, except the four distal abutments of all four quadrants, which consisted of porcelain-fused-to-metal with metal occlusion, due to esthetic concerns. The planned treatment of the lower anterior area also consisted of the placement of implants, but we had to postpone that part of the treatment because the patient was going abroad for work and thus had insufficient time for the surgery. As such, a removable partial denture was applied to this patient as an interim treatment.

Summary

Although it is not yet possible to make decisions regarding the treatment of patients with severe hypodontia based on clear evidence, this case report successfully illustrates an interdisciplinary treatment combining the disciplines of orthodontics, implant surgery, and prosthodontics for a severe hypodontia pa-

tient. The strategy used in this case—i.e., orthodontic tooth movement combined with bone augmentation surgery—can make a treatment involving the placement of implants more predictable and valid, especially in a patient whose alveolar bone quality is poor and insufficient.

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