

Case Report

Interdisciplinary treatment modality for a patient with hypodontia by using orthodontic alignment to avoid adjacent implants in esthetic zone: A clinical report.

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Running title: Orthodontic alignment to avoid adjacent implants

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Abstract

A 20-year-old man with congenitally missing bilateral mandibular second premolars and central incisors presented for treatment. By using orthodontic alignment, redistributing the missing tooth space could avoid adjacent implants to achieve better esthetic outcomes. The prosthodontic treatment consisted placing 4 implants in the mandibular bilateral second premolar and incisor sites.

Introduction

Hypodontia of permanent teeth is fairly common in contemporary populations and is the most common human malformation, the prevalence ranges from about 2% in Taiwanese¹ to 30% in Japanese population². Hypodontia of six or more permanent teeth is defined as oligodontia, which is relatively rare, and the prevalence declines with increasing number of missing teeth². Patients with hypodontia often present with a number of features that require extensive and complex treatment, such as short and retrognathic maxilla, prognathic mandible, and shorter lower anterior facial height³. Intra-orally, bimaxillary retroclination of incisors, spacing, centerline discrepancies, microdontia, hypoplastic enamels, ankylosis of the retained primary teeth, over-eruptions, and volume deficiencies of alveolar ridges are also frequently presented⁴. Above all the problems, coordination of a number of specialties might be necessary to idealize the restorative treatment. The options of final prostheses to restore missing teeth of hypodontia could be various, from removable partial dentures, conventional and adhesive fixed dental prostheses (FDPs) to implant-supported prostheses.

Implant-supported prostheses have been introduced for a long history, providing predictable and reliable treatment alternatives. Despite the high success rate, achieving the natural outcomes in the aesthetic zone could still be challenging, especially when it comes to adjacent implants. In many cases, the loss of 2 or more anterior teeth often result in flattening of the inter-proximal bony scallop, resorption of inter-proximal bone crest, and causing long implant restorations with missing or compromised inter-implant papilla⁵. This clinical report describes the rationale and treatment of a patient with hypodontia using implants and orthodontic alignment to solve the dilemma of multiple adjacent anterior implants.

Clinical report

A 20-year-old male patient came to our hospital with a chief complaint that his front teeth were "small and ugly." He asked for restoring mandibular anterior missing teeth. Comprehensive clinical and radiographic examination showed congenital missing of multiple teeth, including mandibular bilateral permanent second premolars, as well as two mandibular central incisors. In the meantime, two primary central incisors were present, as well as the mandibular left primary second molar. (Fig.1 and 2) According to Angle's classification, occlusal analysis revealed the Class III malocclusion. Other dental problems included multiple tooth spacings in the maxilla and mandible, lower dental midline shifting to left side for 2 mm, and deep overbite with vertical overlap of 6mm. Extra-oral examination showed concave lateral profile without gummy smile. The patient did not present with any systemic or genetic disorder that could be associated with hypodontia, and the oral hygiene status was satisfactory.

In order to develop an ideal occlusal intercuspation and to improve lateral profile, space was re-created for mandibular right second premolar by using orthodontic treatment after the model setup and diagnostic wax up to precise the amount of tooth space and position. It was determined that the mandibular left primary second molar should be extracted due to radiographic signs of root resorption (Fig.2). Both mandibular second premolars were restored with tissue level implant (RN Roxolid® SLA® Implants Ø 4.1 mm, Straumann AG). Mandibular left lateral incisor was aligned to substitute left central incisor, leaving two single tooth spaces at mandibular right central incisor and left lateral incisor sites (Fig.3). After the spaces were properly distributed, two narrow implants were placed (Bone level implant - Narrow CrossFit® Ø 3.3 mm; Straumann AG) with the aid of surgical stent. After 3 months of osseointegration, autopolymerized bisacrylic composite resin (Protemp 3 Garant; 3M ESPE) and titanium temporary abutments (synOcta Temporary Abutment; Straumann



Figure 1. Pretreatment condition. (A) Frontal view. (B) Mandibular occlusal view. (C) Deciduous mandibular central incisors.

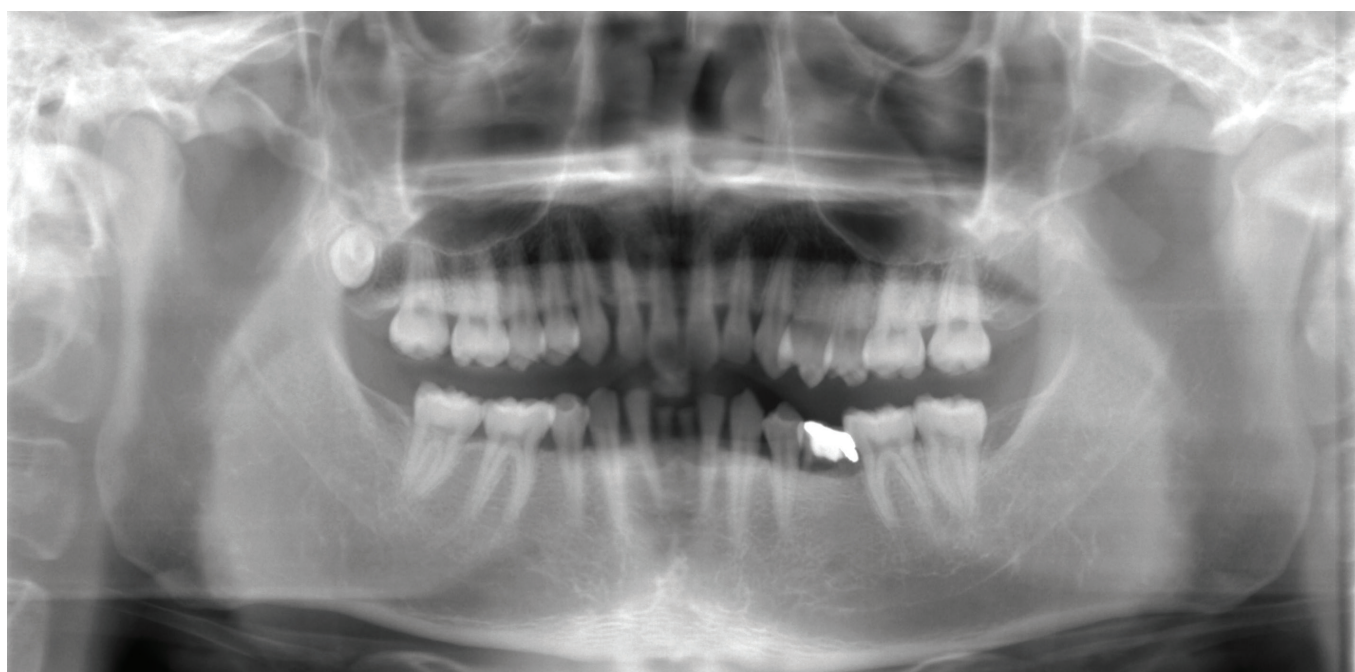


Figure 2. Pretreatment panoramic radiograph.

AG) were used to make the provisional restorations. Six months after orthodontic finishing, an open tray impression was made at implant level using a customized impression coping and polyvinyl siloxane (Aquasil Ultra XLV and Aquasil Soft Putty; Dentsply Caulk). Zirconia framework with labial veneering porcelain design was chosen. The porcelain-fused-to-zirconia copings were bonded to the titanium inserts (Variobase Abutment; Straumann AG) with resin cement (RelyX Unicem; 3M ESPE) to make a 1-piece screw-retained single crown. The definitive crowns were delivered uneventfully after clinical adjustment (Fig.4 and 5). In mandibular anterior esthetic zone, harmonious gingival margin, tooth shape and adequate papilla height were recorded. For the first year of

treatment, the patient was given routine hygiene and maintenance therapy every 3 months for long-term outcome assessment. The 3-year-follow-up revealed maintenance of orthodontic treatment, occlusal plane, oral hygiene, esthetics, and stability of bone level (Fig.6). No mechanical (ceramic fracture, screw loosening) and biological complications (peri-implantitis) were recorded. The patient acknowledged having improved function and esthetics, and was satisfied with the results.

Discussion

The successful treatment of patients with hypodontia need the interdisciplinary intervention of number of specialties (orthodontist, implantologist and prosthodontist), where each member contributes

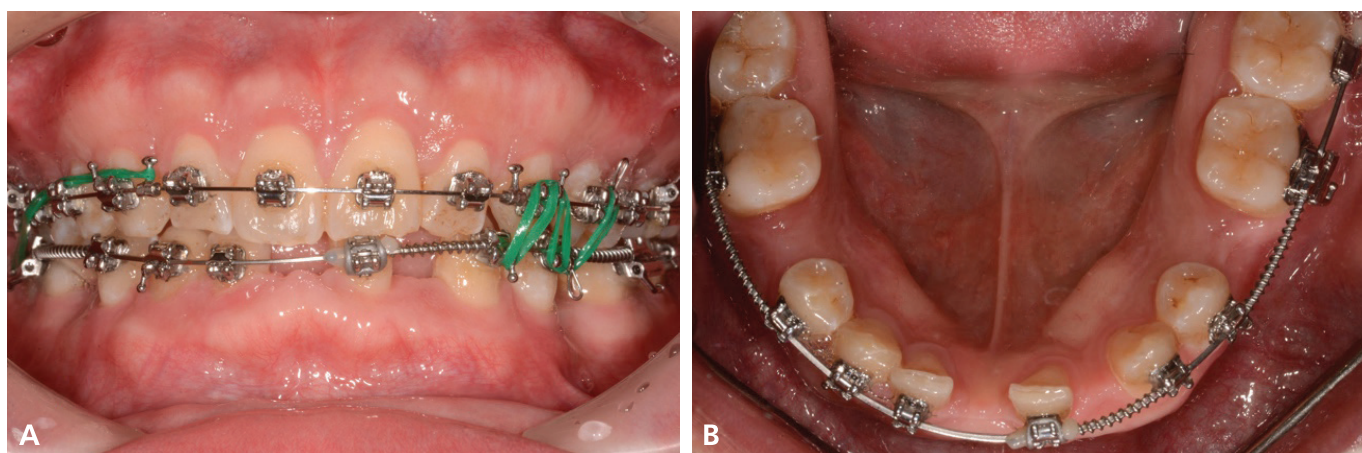


Figure 3. During orthodontic treatment. (A) Frontal view. (B) Mandibular occlusal view

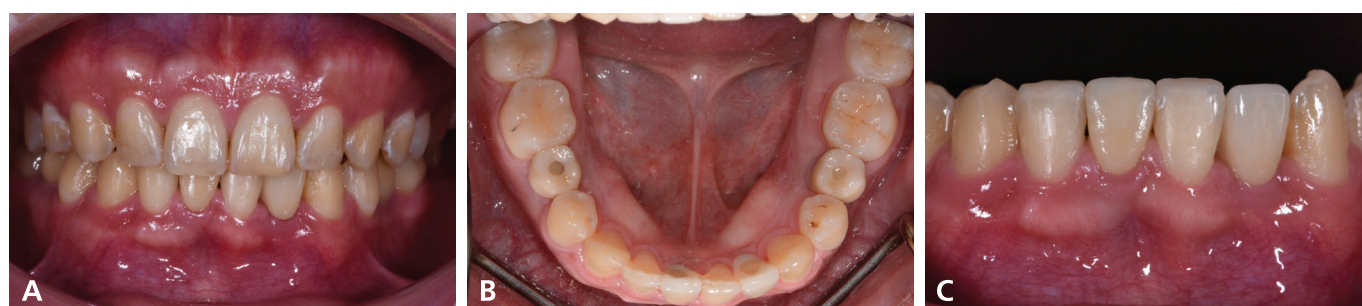


Figure 4. Post-treatment condition. (A) Frontal view. (B) Mandibular occlusal view. (C) Definitive crowns on mandibular right central and left lateral incisor positions.

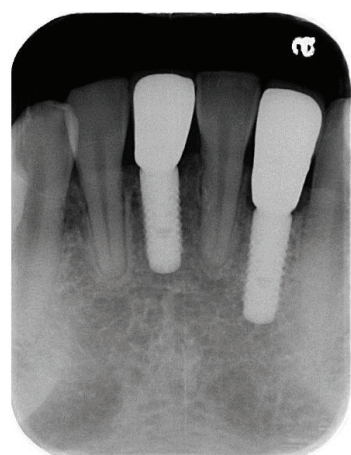


Figure 5. Radiographs after delivery of definitive crowns in mandibular anterior region.

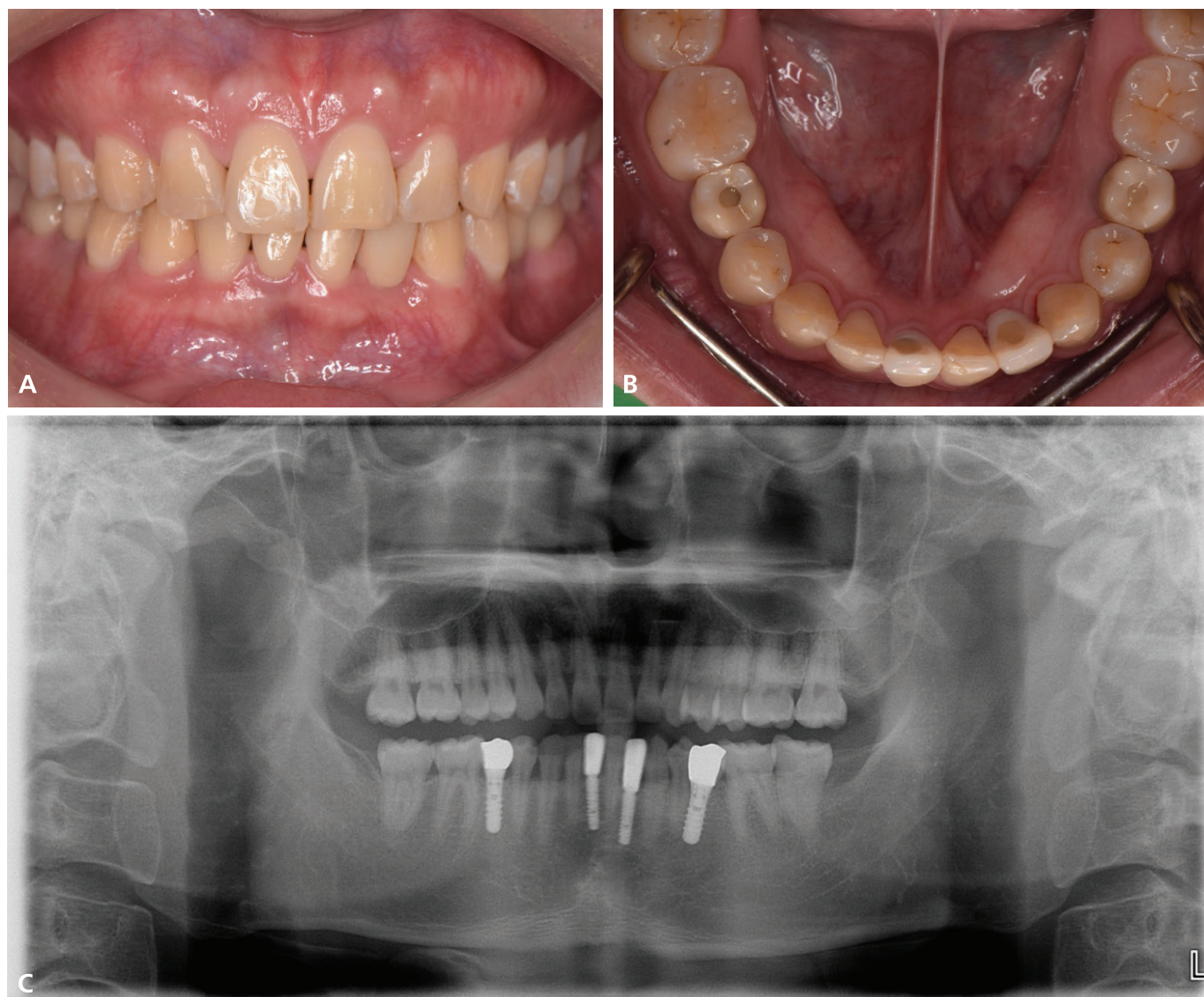


Figure 6. Three years after crown delivery. (A) Frontal view. (B) Mandibular occlusal view. (C) panoramic radiograph.

with a different expertise to achieve an optimal outcome for the patient². Orthodontic treatment allows for the creation or redistribution of spaces for prosthetic rehabilitation, thus, treatment planning could be the most important part, which usually depends on the severity of hypodontia⁶. The treatment options available for these cases are the maintenance of primary teeth⁷; orthodontic space closure; space maintenance; and/or orthodontic space redistribution to facilitate the prosthetic treatment⁸. In this case, the mandibular left primary second molar could not be maintained because root resorption had affected its stability. Instead of closing the space after extraction, the space for mandibular left second premolar had been maintained. In the meantime, space was re-created for mandibular right second premolar. The advantage of space opening include improvement of both function and occlusion, leading to better intercuspation⁹. But its major disadvantage is that

it commits the patient to a definitive prosthesis. On the other hand, closing space could be more time-consuming, and tend to retract the lower anterior teeth, which may cause increased overjet or more concave lateral profile, which both are unfavored.

How to restore two missing mandibular central incisors is another issue in this case. There are several treatment options, such as conventional tooth-supported FDPs and implant-supported prostheses. The patient rejected conventional FDPs at the first place due to unwilling to sacrifice the intact tooth structure. The treatment with dental implants maybe the best option, because this procedure is predictable, stable and provides good esthetic results¹⁰. However, when two adjacent teeth are missing in the aesthetic zone, the presence of the papilla between two implant crowns is determined predominantly by the level of the inter-implant bone crest¹¹. Therefore, only a maximum of 3.4 mm of inter-implant papilla

height should be expected¹², resulting in black triangle or long contact points of adjacent implant crowns to camouflage these defects. It could be very challenging to reach the esthetic demands. To avoid adjacent implants and the following unfavored esthetic result, mandibular left lateral incisor was aligned to substitute left central incisor, leaving two single space at tooth 41 and 32 for two single implant placements. In case of single-tooth replacements, the presences of the papillae are determined predominantly by the attachment levels of the neighboring teeth¹³. In periodontally healthy patients, neighboring teeth enhance the esthetic outcome by maintaining stability of peri-implant papillae. According to clinical retrospective study conducted by Belser et al,¹⁴ anterior maxillary single-tooth implants with 2~4 years follow-up, regardless of uncontrolled factors including timing of implant placement, implant type and design, and type of surgical access flap, the complete papilla fill could be highly achieved (60% in mesial papilla and 29 % in the distal papilla).

There is one more benefit about above method could be addressed. While lateral incisor was pushed mesially to replace central incisor, the root movement creates adequate alveolar ridge width distal to the lateral incisor through stretching of the periodontal ligament, providing better bone condition for implant placement. This process is so-called "orthodontic site development,"¹⁵ and supposed to be accomplished in any part of alveolar ridge, where a tooth will be moved before implant placement.

Optimal Implant positioning in relation to the adjacent teeth could be crucial, inadequate distance between tooth and implant (less than 1.5mm)¹⁶ may result in exaggerated bone loss and increased distance from proximal contact points to the associated alveolar bone crests. Furthermore, not only adequate space must be created for replacement of the tooth crown, but the roots of adjacent teeth should be parallel or slightly divergent to give adequate space for implant placement. The position of the roots of the adjacent teeth should therefore be evaluated radiographically before the appliances are removed¹⁷.

There are potential risks and complications in orthodontic treatment, including dental caries and root resorptions¹⁸. In this case, high standard of oral hygiene was requested, and fluoride mouthwashes had been used through the treatment to prevent caries. Although some degree of external root

resorption is inevitably associated with fixed appliance treatment, no clinically significant root resorption arose in this case, furthermore, resorption rarely compromises the longevity of the teeth¹⁹.

In short, by carefully planning of tooth space distribution, we manage to improve the patient's occlusion, facial profile, better bone and adequate space for implant placement, and avoid the dilemma of adjacent implants at the same time.

Summary

Interdisciplinary planning is the key to treat a patient with hypodontia, decisions about space management must be made by the interdisciplinary team, taking into account the risks and benefits of all options. Re-distributing two adjacent missing spaces into two single space could be a solution to make a better and more predictable esthetic outcome.

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