Journal of Dental Sciences 20 (2025) 1295–1297

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.e-jds.com

Correspondence

Long-term stability of orthodontic implant site development: A 13-year case report

KEYWORDS
Orthodontics;
Dental implants;
Ridge dimension;
Ridge augmentation;
Long-term stability

Patients with stage IV periodontitis often present with multiple missing teeth and inadequate space or atrophic ridges for implant placement. Orthodontic implant site development (OISD) is a non-invasive approach to augment the reduced edentulous ridge and optimize the implant site.[1,2] Additionally, OISD may help avoid unfavorable implant sites, sinus and bone pathology, and the need for major reconstructive surgeries.[3] However, the long-term outcomes and stability of dental implants placed in orthodontically developed sites remain unclear. This 13-year case report aimed to evaluate the long-term stability of ridge dimensions following OISD.

A 30-year-old male patient with Stage IV periodontitis was referred to the Periodontal Department at Taipei Tzu Chi Hospital, Taiwan, with concerns about diastema and multiple missing teeth. A ridge defect at the tooth 15 site rendered implant placement impossible without major reconstructive surgery (Fig. 1A).

To create a more suitable implant site, orthodontic therapy was used to move the tooth 14 tooth into the tooth 15 position. A mini-screw was inserted into the buccal plate of tooth 16, and both the mini-screw and an open coil spring (placed between tooth 13 and tooth 14) were immediately loaded with light force to facilitate the distal movement of the left first premolar.

After 15 months, the first premolar had moved 7 mm distally, creating sufficient space and alveolar bone for implant placement at the tooth 14 site (Fig. 1B). A flapless placement of a 4.3 × 10 mm one-piece implant (Nobel Direct, Nobel BioCare, Gothenburg, Sweden) was performed, and a provisional restoration was placed two months later as orthodontic anchorage (Fig. 1C).

At the 13-year follow-up, 1 mm marginal tissue recession was observed at the tooth 15 site, while 2 mm of recession was noted at the tooth 14 implant site. Periapical radiographs and cone beam computed tomography (CBCT) scans were taken at both the initial visit and the final follow-up (Fig. 1D). Minimal marginal bone loss was observed at the tooth 15 site, whereas approximately 0.2 mm of marginal bone loss was noted at the tooth 14 implant site.

CBCT data indicated that orthodontic tooth movement into an edentulous area resulted in only minor dimensional changes to the periodontal tissues, with the buccolingual width of the edentulous ridge increasing by 38 % following tooth movement. In contrast, jaw segments that became edentulous after orthodontic tooth movement and implant placement exhibited a 5 % decrease in buccolingual dimension.

To the best of the authors' knowledge, this is the first long-term report on orthodontic implant site development (OISD). This case report demonstrates that periodontal and peri-implant health as well as ridge dimensions can be maintained for 13 years following OISD. The dimensional changes observed in the tooth-augmented ridge and the newly created edentulous ridge were consistent with the findings of Lindskog-Stokland et al.[4]

In a systematic review and meta-analysis, Elnayef et al. concluded that, regardless of the material used for

https://doi.org/10.1016/j.jds.2025.02.011

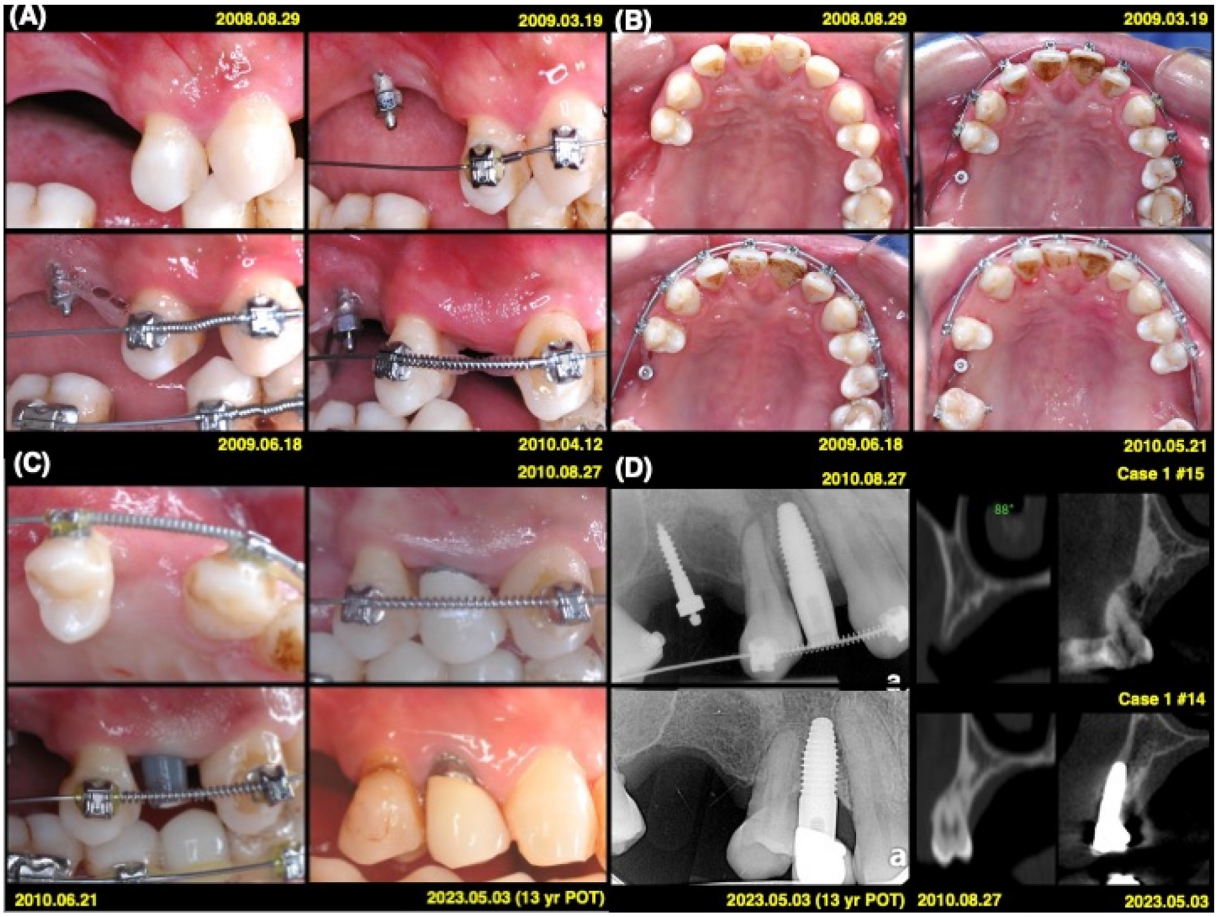

Figure 1 Clinical photographs and radiographs of the patient. (A) A 30-year-old male patient with Stage IV periodontitis presented with complaints of diastema and multiple missing teeth. A ridge defect at the tooth 15 site made implant placement impossible without major reconstructive surgery. Orthodontic therapy was initiated to move the tooth 14 into the tooth 15 position, creating a more suitable site for implant placement. A mini-screw was inserted into the buccal plate of tooth 16, and both the mini-screw and an open coil spring (positioned between tooth 13 and tooth 14) were immediately loaded with light force to facilitate the distal movement of the left first premolar. (B) After 15 months, 7 mm of distal movement of the first premolar created sufficient space and alveolar bone for the tooth 14 implant site. (C) Flapless implant placement was performed, and a provisional restoration was placed two months post-implantation as orthodontic anchorage. Minimal marginal tissue recession was observed at the tooth 15 site, while 2 mm of marginal tissue recession was noted at the tooth 14 implant site after 13 years of follow-up. (D) Periapical radiographs and CBCT scans were obtained at the initial visit and the final follow-up. Minimal marginal bone loss was observed at the tooth 15 site, while approximately 0.2 mm of marginal bone loss was recorded at the tooth 14 implant site after 13 years of follow-up. CBCT scan data indicated that orthodontic tooth movement into an edentulous area resulted in only minor dimensional changes to the periodontal tissues, with the buccolingual width of the edentulous ridge increasing by 38 % following tooth movement. In contrast, jaw segments that became edentulous after orthodontic tooth movement and implant therapy exhibited a 5 % decrease in buccolingual dimension.

regeneration, various degrees of graft resorption are expected, and overcorrection of horizontal defects should be performed to compensate for graft resorption.[5] In carefully selected cases, OISD may reduce or eliminate the need for advanced surgical procedures while minimizing ridge resorption. In this case, the duration of orthodontic movement to create the premolar implant site was 15 months. Many researchers have suggested that the periosteum on the labial and lingual surfaces of the alveolus contributes to bone formation during the slow, controlled movement of teeth into edentulous areas with reduced bone height[1,3] The rate of tooth movement in this case was approximately 1 mm per month. However, if the teeth are moved too rapidly, there is an increased risk of bone dehiscence and marginal tissue recession.[3]

Zachrisson suggested that the mineral content, radiodensity, and tensile strength of orthodontically regenerated bone may be lower.[3] After creating adequate space, the regenerated bone was allowed to mature for 3—4 months before implant placement. In the present case, the orthodontically created implant site was classified as type III bone; therefore, a provisional implant restoration was placed two months after implant placement. The bone quality between implant sites developed through tooth movement and those developed via guided bone regeneration may differ and warrants further investigation.

Within the constraints of this 13-year case report, OISD was successfully utilized as an alternative approach for implant site development and ridge augmentation. The key determinants of implant success in this case included careful patient selection, adequate bone width, progressive loading, proper restorative contour and margin design, meticulous plaque control, and regular maintenance. Further prospective, controlled studies with larger sample sizes are needed to validate these findings.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

Acknowledgments

The author would like to express gratitude to Drs. Nie-shiuh Chang and Jing-Jong Lin for their mentorship and critique in interdisciplinary treatment planning. This study was supported by a grant from the Taipei Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation. (TCRD-TPE-114-54)

References

1. Zachrisson BU. Current trends in adult treatment. *J Clin Orthod* 2005;39:285—96.
2. Kokich VG, Kokich VO. Congenitally missing mandibular second premolars: clinical options. *Am J Orthod Dentofacial Orthop* 2006;130:437—44.
3. Borzabadi-Farahani A, Zadeh HH. Adjunctive orthodontic applications in dental implantology. *J Oral Implantol* 2015;41:501—8.
4. Lindskog-Stokland B, Wennstrom JL, Nyman S, Thilander B. Orthodontic tooth movement into edentulous areas with reduced bone height. An experimental study in the dog. *Eur J Orthod* 1993;15:89—96.
5. Elnayef B, Porta C, Suárez-López Del Amo F, Mordini L, Gargallo-Albiol J, Hernández-Alfaro F. The fate of lateral ridge augmentation: a systematic review and meta-analysis. *Int J Oral Maxillofac Implants* 2018;33:622—35.

Cheng-Shan Li
Yuan-Yang Hsu
Ting-Hsin Huang
Department of Dentistry, Taipei Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, New Taipei City, Taiwan

Shing-Zeng Dung*
Department of Dentistry, Taipei Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, New Taipei City, Taiwan
Department of Surgery, College of Medicine, Tzu Chi University, Hualien, Taiwan
College of Dentistry, National Yang Ming Chiao Tung University, Taipei, Taiwan
Department of Stomatology, Taipei Veterans General Hospital, Taipei, Taiwan

*Corresponding author. Department of Dentistry, Taipei Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, No. 289, Jianguo Rd., Xindian Dist., New Taipei City 23142, Taiwan.
E-mail address: tonyangela0103@gmail.com (S.-Z. Dung)

Received 8 February 2025
Final revision received 10 February 2025
Available online 20 February 2025