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Long-term stability of maxillary anterior tooth-implant supported fixed prostheses: A 14-year case report

KEYWORDS
Anterior maxilla;
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Longitudinal

Patients with stage IV periodontitis frequently present multiple missing teeth, compounded by severe alveolar ridge resorption at potential implant sites. Tooth-implant supported prostheses (TISP) may help mitigate the need for complex reconstructive surgery and prevent improper implant positioning. While long-term outcomes of TISP in posterior regions have been well-documented,[1] evidence regarding their use in the anterior maxilla remains scarce. This 14-year case report aims to evaluate the long-term stability of TISP in the anterior maxilla.

A 68-year-old male patient with Stage IV periodontitis was referred to the Periodontal Department at Taipei Tzu Chi Hospital, Taiwan, presenting with concerns about tooth mobility and multiple missing teeth. Due to the patient's reluctance to undergo tooth extraction and the presence of excessive tooth wear, a fixed dental prosthesis was planned to protect tooth 11 from further damage. Tooth 21, however, exhibited severe mobility and bone loss, warranting extraction. A pronounced ridge defect at the site of tooth 21 rendered implant placement unfeasible without extensive reconstructive surgery. To avoid complex soft and hard tissue reconstruction, the surgical plan was divided into three steps: (1) guided bone regeneration (GBR) with immediate implant placement at the tooth 12 site; (2) alveolar ridge preservation at the tooth 21 site; and (3) GBR with simultaneous implant placement at the tooth 22 site (Fig. 1A). Primary stability was achieved at both implant sites 12 and 22 with insertion torques exceeding 35 Ncm. A periapical radiograph was taken immediately after surgery. A provisional restoration was placed two months after implant placement. Six months following implant placement, a definitive single crown was delivered for implant 12, and a three-unit TISP was placed from tooth 11 to implant 22 (Fig. 1B). Canine involved group function occlusion was established to minimize stress on the TISP in the anterior maxilla. At the 14-year follow-up, probing depths remained within normal limits and no bleeding on probing was observed at tooth 11. Approximately 1 mm of marginal tissue recession was noted on the labial aspect of both tooth 11 and implant 22 (Fig. 1C). Periapical radiographs taken at the final follow-up revealed minimal marginal bone loss at the sites of tooth 11 and implant 22 (Fig. 1D).

To the best of the authors' knowledge, this may be the first long-term report on TISP in the anterior maxilla. This case report demonstrates that both periodontal and peri-implant health of TISP can be maintained for 14 years. In the anterior maxilla, when interdental papilla preservation is a critical concern for esthetics or phonetics, TISP may be advantageous, as the supracrestal gingival fibers associated with healthy tooth contribute to interproximal soft tissue support. While this patient had a low smile line and no esthetic complaints, a more pronounced papilla was

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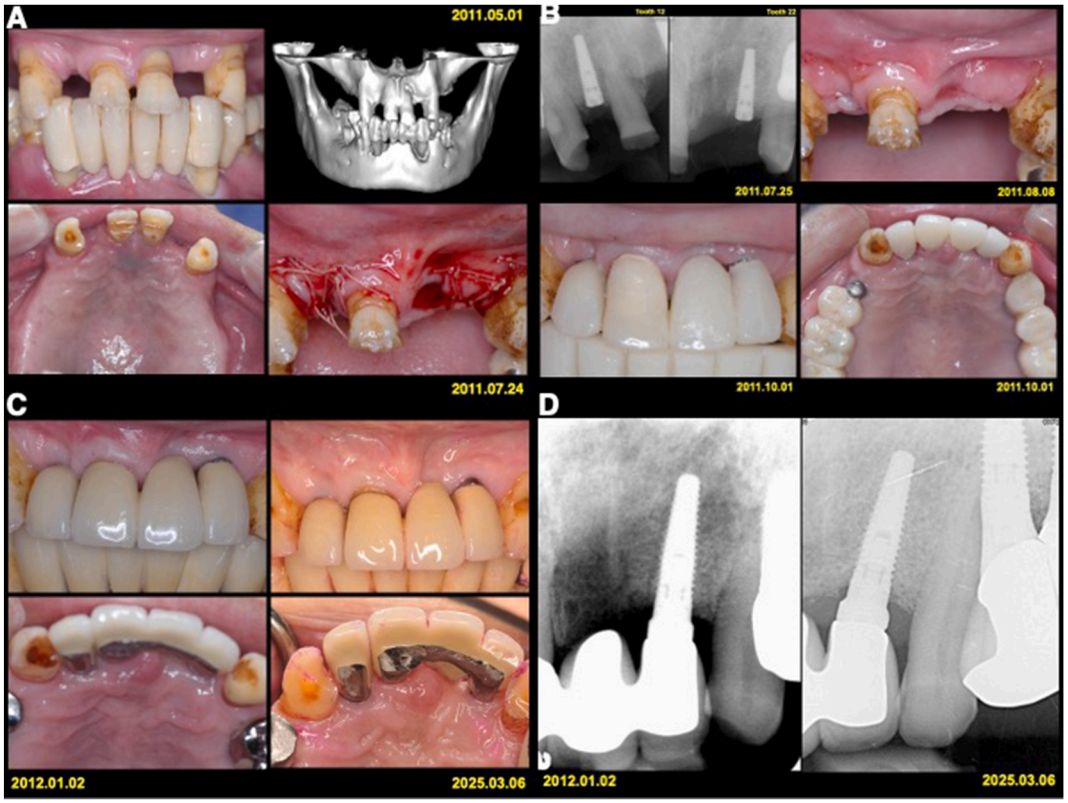

Figure 1 Clinical photographs and radiographs of the patient.
(A) A 68-year-old male patient with Stage IV periodontitis presented with complaints of tooth mobility and multiple missing teeth. Due to excessive wear, a fixed dental prosthesis was planned to protect tooth 11 from further damage. Additionally, tooth 21 required extraction due to severe mobility and significant bone loss. However, a ridge defect at the site of tooth 21 made implant placement impossible without extensive reconstructive surgery. To avoid complex soft and hard tissue reconstruction, the surgical plan was divided into three steps:[1] guided bone regeneration (GBR) with immediate implant placement at the tooth 12 site;[2] alveolar ridge preservation at the tooth 21 site; and[3] GBR with simultaneous implant placement at the tooth 22 site (B) A periapical radiograph was taken immediately after the surgery. The insertion torque of both implants at sites 12 and 22 exceeded 35 Ncm, indicating primary stability was achieved. A provisional restoration was placed two months after implant placement (C) Six months after implantation, definitive prostheses were placed: implant 12 supported single crown, while tooth 11 to implant 22 were tooth-implant supported fixed prostheses. Canine involved group function occlusion was designed to minimize stress on the tooth-implant supported prostheses (TISP) in the anterior maxilla. After the 14-year follow-up, approximately 1 mm of marginal tissue recession was observed on the labial side at tooth 11 and implant 22. On the palatal side, approximately 1.5 mm and 1 mm of marginal tissue recession were observed at tooth 23 and implant 22, respectively (D) Periapical radiographs were obtained at the final follow-up. Minimal marginal bone loss was observed at the site of implant 22 after 14 years.

observed between implant 12 and tooth 11 compared to the pontic area between implant 22 and tooth 21 (Fig. 1C).

Rammelsberg et al.[1] found no statistically significant differences in failure rates among 213 ISP, 66 implant cantilever prostheses, and 155 TISP. Additionally, failure rates did not differ significantly by location, including 48 cases in the anterior region, 308 in the posterior region, and 80 spanning both anterior and posterior regions. Reported survival rates reached 96 % at 5 years and 91 % at 10 years for implants overall, with TISP showing 89 % survival at 10 years. Alsabeeha et al.[2] conducted a systematic review and meta-analysis comparing TISP and ISP in terms of implant and prosthetic outcomes, as well as biological and technical complications. Abutment tooth intrusion rate was 3 %, with tooth fracture rates ranging from 0 % to 4 %. Peri-implant bone loss was marginally lower in TISP. Technical complications were comparable, though framework fractures and screw loosening were more common in TISP, while ISP showed more porcelain fractures. Both approaches yielded comparable overall outcomes, reinforcing the viability of TISP.

Borg et al.[3] emphasized the biomechanical considerations inherent in TISP due to the disparity in mobility between teeth and implants. Periodontally healthy teeth exhibit vertical displacement of approximately 28 μm during physiological function and horizontal displacement of 100—120 μm under a 5 N oblique load. Notably, anterior teeth demonstrate more horizontal mobility compared to posterior teeth. In contrast, osseointegrated implants exhibit minimal vertical displacement (2—3 μm) and buccolingual movement (12—66 μm) under forces up to 45 N. Thus, TISP in the anterior maxilla may experience increased horizontal displacement under oblique loading. However, Borg et al. noted that sufficient flexibility within TISP can accommodate such biomechanical differences, enabling even occlusal force distribution. They concluded that rigid,

permanently cemented TISP with minimal prosthetic components could achieve long-term success in patients with good oral hygiene. Similarly, Hosny et al.[4] compared ISP and TISP using a split-mouth study design in 18 patients over 14 years, and concluded that no significant differences were observed in marginal bone loss or mechanical complications. Notably, no prosthetic complications such as crown cement failure or natural tooth intrusion were reported. In our report, after 14 years of follow-up, the three-unit TISP remained stable with no mechanical or biological complications. This success may be attributed in part to the presence of well-integrated anterior and posterior mandibular ISPs, which provided adequate occlusal support and reduced functional stress on the anterior TISP.[5]

Within the limitations of this case report, TISP appears to be a viable alternative treatment option for partially edentulous patients in the anterior maxilla. Key contributors to clinical success included strict patient selection, a healthy abutment tooth, stable lower anterior ISP, sufficient posterior occlusal support, a rigid tooth—implant connection including permanent cementation of TISP, progressive loading, optimal restorative contour and margin design, meticulous plaque control, and regular maintenance. More prospective studies with larger sample sizes are needed to substantiate these findings.

Declaration of competing interest

The authors declare no conflicts of interest.

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