

MINI ONGOING IMPLANT TO REPLACE ANTERIOR SINGLE MISSING TOOTH WITH LIMITED SPACE: A CLINICAL REPORT

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For a missing teeth, orthodontic treatment may be a better choice of treatment in comparison to a conventional prosthetic replacement such as FPD, resin bonded prosthesis in view of aesthetics, periodontal health and function. Occasionally after an orthodontic treatment, an insufficient space may occur. The mini-implant could be an alternative in situations of narrow ridge dimension, where conventional root form implant could be compromised. The aim of this clinical report is to describe how a space that could not be restored with a traditional root form endosteal implant was managed and to present a technique to achieve optimal anterior esthetics in single implant restoration.

Key Words

Mini implant, Single implant restoration, Ongoing implant

Over the past 25 years the use of osseointegrated implants has become one of reliable treatment options for fully and partially edentulous ridges with a high success rate.¹⁻⁵ The increase in success rates of implants for the edentulous patients has challenged dentists to expand its application into the rehabilitation of partially edentulous and single-tooth missing areas.^{1,2} Many human studies on the osseointegration of the implant have demonstrated the validity of single-tooth implant and with the development of

UCLA abutment, single implants were applied widely to both anterior and posterior single missing areas.^{3-4,6,7} The cumulative success rate of 98.5% was reported by Jemt and Petterson in a 3-year retrospective study for single implant.⁴ Walther et al. reported the success probability of 0.89 (Kaplan-Meier method) for anterior single implants over a period of 10 years. He also showed the failure rate for implant on lateral incisors which was lower than that of central incisors.⁸ Mini implant with 2.9mm diameter used in a single tooth replacement had a success

rate of 94.2% at 5-year retrospective study, which is similar to that of regular-sized implants.⁹

At first, mini implant system was introduced for the retention of provisional prosthesis only, to support interim dentures or fixed prosthesis to improve esthetics, mastication, phonation, patient's comfort and to ensure stress-free healing of the bone surrounding the implants during the healing period.¹⁰⁻¹² After being in function for approximately 3 to 6 months, they were removed when final restoration was delivered. With this limited usage, single tooth missing area was not be restored by mini implant.

The osseointegration of mini implant was evaluated clinically and histologically through mobility test and bone to implant contact proportion and showed acceptable results of matured remodeled bone with vascular elements.^{10,11} In Balkin's study, titanium 6-4 alloy and auto-advancing technique provided healthy and well integrated bone.¹¹ The maxillary lateral incisors and second premolars have been found to be the second most missing teeth.^{1,12} In cases of congenitally missing teeth on maxillary lateral incisors, orthodontic treatment may be a better choice compared to the prosthetic replacement such as FPD, resin bonded prosthesis in view of aesthetics, periodontal health and function.¹² Following

orthodontic treatment insufficient space may occur. The mini-implants could be the alternatives in situations of narrow ridge dimension, where conventional root form implant could be compromised.⁹

Based on the above evidence, a mini implant has been utilized to restore the congenitally missing lateral incisor. The aim of this clinical report is to describe how to manage with the space that could not be restored with a traditional root form endosteal implants and to present a technique to achieve optimal anterior esthetics in the implant prosthesis.

CLINICAL REPORT

A 23-year-old man referred from orthodontic department attended the graduate prosthodontic clinic at the University of Yonsei, College of Dentistry for the treatment of missing lateral incisor. The patient presented class III skeletal pattern, crowding on the mandibular teeth and a congenitally absent tooth in the maxillary right lateral incisor. The mandible was set back by orthognatic surgery and further orthodontic treatment was delivered.

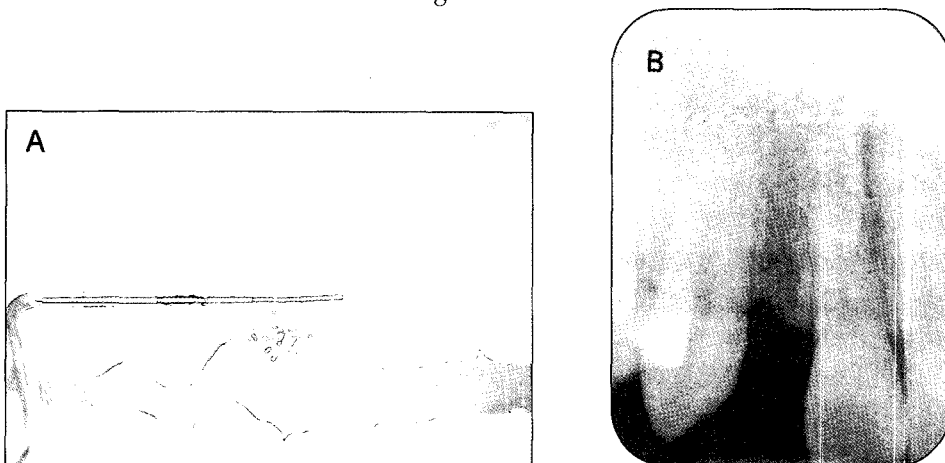


Fig. 1. Insufficient mesiodistal distance for conventional root form endosseous implant. Distance was approximately 5 mm(left) at maximum height of contour.

The mesiodistal distance at the missing tooth area was 5mm which was insufficient for the conventional osseous dental implant. Radiographic examination showed an adequate level of the alveolar bone in the region of the missing area (Fig. 1). After a comprehensive examination, an implant-supported prosthesis with ongoing mini implant to replace the missing tooth was planned.

A mini implant (Sendax MDI; IMTEC, Admore, Okla) with 1.8mm in diameter and 13mm in length was placed in the maxillary right lateral incisor under local anesthesia (Fig. 2). No incision was necessary to place the mini implant. A 1.1mm titanium drill (Sendax MDI; Imtec, Admore, Okla) was used to penetrate the soft tissue and cortical plate of bone and prepared into one third of the final depth of the implant. At this point, radiographic examination was performed to evaluate the position and the direction of the implant. The penetration through the gingival site must have attached gingiva surrounding the implant site. Auto-advance with finger drive (Imtec;Admore: Okla) was used to carry the mini implant to the premarked initial point followed by thumb driver and the final turns were accomplished using a ratchet driver or wrench. When

using the ratchet driver (Imtec;Admore: Okla), excessive pressure and heat generation must be avoided by applying a slow, precise insertion.

An immediate provisional prosthesis was fabricated on the day of surgery with auto-polymerized acrylic resin (Jet acrylic; Lang Dental Mfg Co, Wheeling, Ill) using a vacuum formed index which was a duplicate of a diagnostic wax pattern. The patient was informed to have soft diet and avoid excessive masticatory force on the anterior region. After gingival healing the length of the provisional was shorter than adjacent teeth. In order to overcome this unaesthetic situation, gingivoplasty was performed to increase crown length, thus to harmonize with the adjacent teeth. One month after implant placement, gingivoplasty in a shape of 3mm depth wedge form was performed (Fig. 3). The facial aspect of the attached gingiva was resected under local anesthesia and surgical pack (Coe-Pak; GC America Inc., Alsip, Ill) was placed. The cervical portion of the provisional crown was modified similar to ovate pontic below the marginal gingiva and secured without cementation at the same day (Fig. 4).

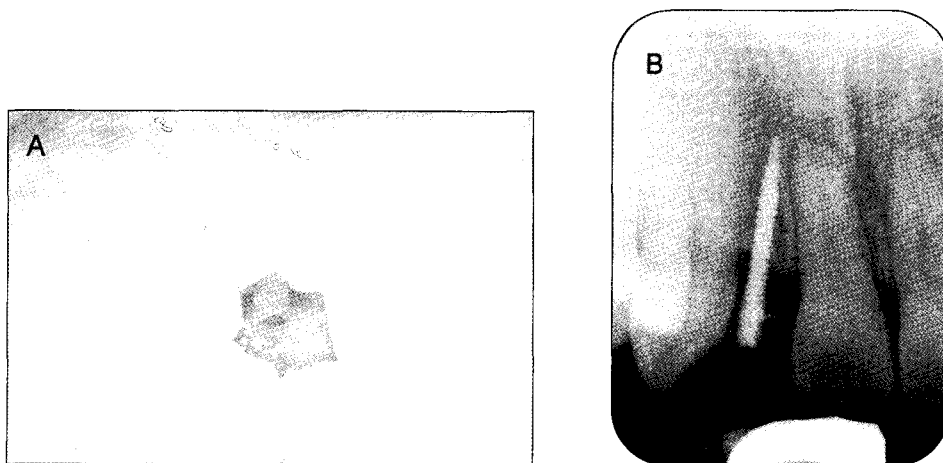


Fig. 2. Intraoral and radiographic view of installed mini implant.

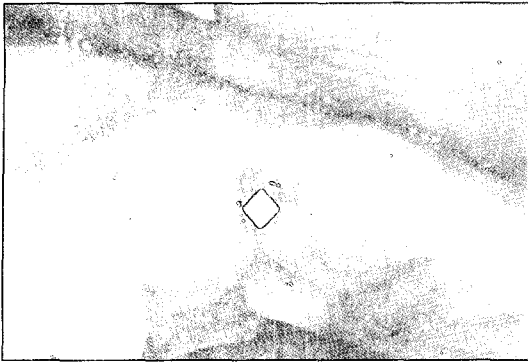


Fig. 3. After performance of wedge shaped gingivoplasty. (occlusal view)

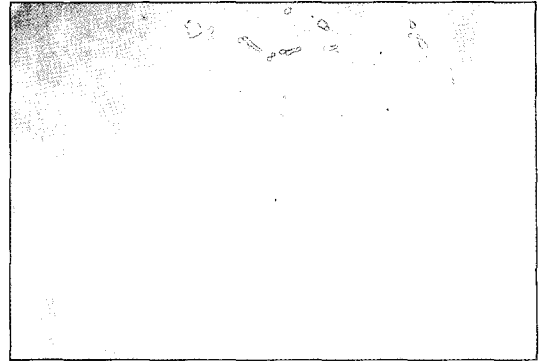


Fig. 4. Provisional restoration was corrected to ovate form to give natural emergence profile and contour.

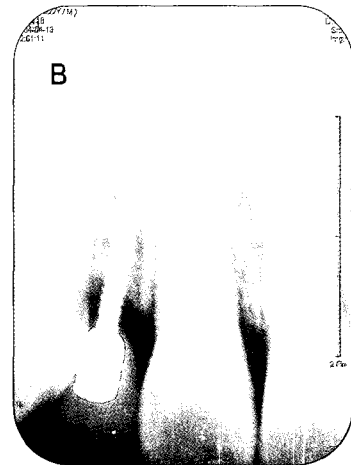
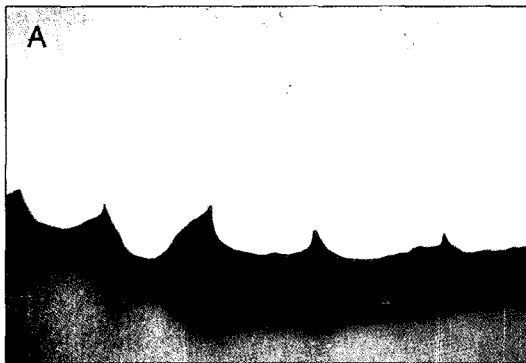


Fig. 5. In view of delivered GES ceramic definitive restoration. (left-intraoral view, right-radiograph)

Implant mobility was subsequently measured over the following 2 months and showed no clinical mobility. The bone resorption appeared to be adequate on radiographic examination. At the state of provisional restoration, the crown and the surrounding soft tissue had acceptable results. The provisional crown was removed, and definitive impression was made with polyvinylsiloxane (Aquasil XLV; Dentsply DeTrey GmbH, Konstanz, Germany). The resulting master cast with an implant analogue was mounted

in a semi-adjustable articulator (Hanau Modular; Teledyne WaterPik, Ft. Collins, Colo). The coronal portion of the implant relative to the adjacent teeth was evaluated, and clearance in maximum intercuspation and excursive movements was ensured. Galvano electroforming system (GES) ceramic crown was then fabricated and subsequently evaluated for proximal and occlusal contacts. The patient was satisfied with the esthetic result at the trial insertion appointment. The crown was cemented using zinc oxide eugenol

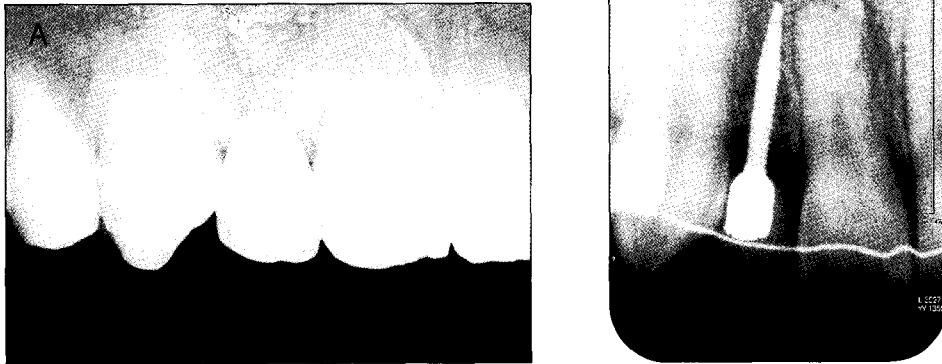


Fig. 6. Six-month check-up appointment.

cement (Temp-Bond; Kerr Corp, Romulus, Mich) (Fig. 5). Six months after implant placement, clinical and radiographic examination was satisfactory with minimal bone level changes and maintenance of soft tissue health (Fig. 6).

DISCUSSION

High success rates of over 90% in conventional implants in fully or partially edentulous ridges had been established through many longitudinal multi-center studies.³⁻⁵ Cautious start even in single implant treatment had been proven to be also a part of confident treatment modality in implant dentistry.⁴

In the early implantation the treatment protocol was to follow a two stage implantation to secure full osseointegration before loading machined surfaced implants, where it achieved over 81% success rate in 15 years.⁵ To advocating load free osseointegration, transitional implantation had been developed. Transitional implants were designed with smaller diameter of near 2mm at various lengths. Mainly as abutments for interim overdenture and loading were placed immediately after implantation until the definitive prosthesis

were delivered. On histological and clinical evaluation have revealed that successful osseointegration were observed in immediately loaded transitional implants.¹⁰

Despite these successes, in daily dental practice dentists were still faced with cases which stretched the limits in which successful implant treatment could be safely carried out using conventional implants. Insufficient mesial and distal space for an implant was one of the conditions. Narrow implants developed in many implant systems have used to overcome this clinical problem. A long term clinical study using 3mm diameter implants showing a high survival rate of 94.2% was described by Balkin et al.¹¹

The machined surface implants and surface treated implants have been compared in terms of removal torque measurements¹² and histomorphometric investigation by Cordioli et al.¹³ They have found acid etched titanium implants had improved torque measurements and bone to implant contact compared to machined implants. This is further supported by a clinical study by Khang et al. The overall success rate of etched implants was higher at 95% over 86.7% with machined surfaced implants and more obvious in

poorer bone quality.¹⁵ In cases of mini ongoing surface-treated implant, the improvement of osseointegration and hard and soft tissue attachment by surface treatment could be also expected.

Reflecting these *in vivo* and *in vitro* studies indicate use of small diameter etched on-going implants in compromised mesio-distal width may have a position in certain clinical indications. However, these on-going implants were not without clinical problems and limitations. One being a compromised pink aesthetics resulted from an unscaloped gingival contour inharmonious with the adjacent teeth and wide cervical embrasures limited clinical use of mini implant for single-tooth rehabilitation. The cervical line of the crown connected to mini implant starts from right above the gingival crest, so that cervical undercontour and absence of interdental papilla make it difficult to reconstruct the natural emergence profile.

In order to obtain acceptable esthetics, the reconstruction of soft tissue, especially the interdental papilla and gingival scallop on the facial aspect should be considered carefully in replacing the missing anterior teeth,¹⁶ which could be achieved by the surgical reshaping of the gingiva combined with recontouring a provisional restoration.^{17,18}

The gingivoplasty, 3mm in this patient, was performed to make cervical margin harmonized with the gingival level of adjacent teeth and offered natural emergence profile. The depth of mini implant was determined by the gingival level of adjacent teeth and thickness of soft tissue on the ridge crest.

Soft tissue dimension are significantly influenced by the presence or absence of a microgap between the implant fixture and abutment, and the marginal gingiva for one-piece implant was significantly located more coronally compared to that of two-piece implant.¹⁹ The long-term stability of gingival margin therefore could be expected.

SUMMARY

The mini implant-supported prosthesis could be used in a single tooth missing area with a satisfying result in esthetics by means of the accurate diagnosis and management of soft tissue reconstruction and provisional restoration. Clinical observation on mobility and the radiographic examination may validate the osseointegration of mini implant to be stable during this limited observation, but further long-term studies should be needed.

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