Use of a New-Generation Mini-Implant and Attachment System for Fabrication of a Maxillary Overdenture

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One-piece mini-implants have been marketed as an option for completely edentulous patients who seek improved retention and stability for their complete dentures and low-morbidity surgical procedures.1 These implants have been categorized as type I narrow-diameter implants, or “mini-implants,” as their diameters are smaller than 3 mm.2 Due to their narrow diameter, implant surgery with these implants can be less invasive and may be performed in a flapless approach in some situations.2,3

The long-term outcomes of mini-implants in the literature have been controversial.2–7 However, a systematic review comprehensively studied the performance of mini-implants and concluded that mini-implants can be considered as an alternative support for overdentures, as they improve the quality of life of edentulous patients with their high survival rates and acceptable bone loss. Mini-implants are considered to be indicated especially in situations where it is not possible to rehabilitate patients with regular implants.3 In a more recent prospective cohort study, it was concluded that mini-implants had very high survival and success rates after 5 years when used for elderly patients.6

Mini-implants and their abutments are manufactured in one piece and thus include the attachment for increasing retention of the dentures.8 Ball attachments and Locators have been widely used for this purpose. A recent miniaturized stud-type attachment system has been introduced to be used with mini-implants. This system has a matrix that contains the attachments, which are made of polyether ether ketone (PEEK), and a patrix, which is made of grade IV titanium covered with a new type of surface that may result in reduced wear of the components.9 To the authors’ knowledge, there are no reports in the literature that document the use of this attachment combined with a new-generation mini-implant. This clinical report describes the use of a new mini-implant system with a recent attachment to retain a maxillary overdenture for a patient with limited maxillary bone volume.
A 68-year-old patient presented to the Department of Reconstructive Dentistry and Gerodontontology, University of Bern, Bern, Switzerland. The patient had a history of squamous cell carcinoma of the tongue, successfully treated 3 years prior at the Department of Cranio-Maxillofacial Surgery, and smoked 30 cigarettes/day without willingness to reduce. Before the cancer treatment, the patient had all teeth extracted except for the mandibular left canine and had an implant placed at the site of the mandibular right canine (Standard Implant RN, Straumann). A mandibular overdenture on telescopic crowns on the natural canine and on the implant at the canine site was then fabricated, along with a complete denture for the maxilla.

The patient later received two additional implants (SI-Cace 4.0 x 6.0 mm, SIC invent) placed at the mandibular first molar sites to support the overdenture with ball attachments. At the examination appointment 2 years after this improvement of the mandibular overdenture, the patient complained that the maxillary complete denture was unstable and loose and requested a more retentive maxillary complete denture with no palatal coverage. A panoramic radiograph was taken (Fig 1), and then a CBCT scan (3D Accuitomo 170, Morita) was performed to evaluate the maxillary bone volume further. Due to the limited bone volume, mini-implants placed with a flapless procedure in the anterior maxilla were presented as a treatment option. Alternative options included regular-diameter implant placement in the posterior maxilla with simultaneous maxillary sinus grafting.

The patient declined bone grafting due to the surgical invasiveness and cost and selected the mini-implant option with flapless placement. The existing complete denture was used for diagnostic evaluation and deemed adequate. A preoperative CBCT confirmed sufficient crest dimensions in the anterior maxilla. The approximate distance between the crest midline and the most distal site with sufficient crest height before onset of alveolar recession was measured and considered during surgery. For this purpose, the most distal implant position as defined in the CBCT scan was identified intraoperatively with a caliper and marked after local infiltration with articaine (4%) and adrenaline (5 µg/mL) (Fig 2). The remaining four implant positions were equally distributed between these two most distal implants. Finally, the six mini-implants (Mini Implant System, Straumann) were placed according to the manufacturer’s instructions for soft bone using the flapless placement approach. The final insertion torque was between 18 and 25 Ncm for all implants (Fig 3). After implant placement, a CBCT scan revealed favorable implant positions (Fig 4). The denture was relieved in the areas of the implants to avoid direct contact between the denture base and the implants. Subsequently, a soft-tissue conditioner was applied to temporarily reline the denture (F.I.T.T., Kerr).

The healing was uneventful at the 2-week follow-up appointment (Fig 5). After 4 months of uneventful healing without functional loading, the matrices of the attachment system (Optiloc, Straumann) were snapped.
onto the implants to make the definitive impression (Fig 6). The denture was relieved in the areas of the housings to ensure interference-free fit. This resulted in the perforation of the palatal aspect of the denture. Therefore, the denture was modified with compound material (Kavo Kerr) in this area to ensure accurate impression-taking (Fig 7). Then, a definitive reline impression was made using the existing complete denture and vinylsiloxanether (Identium, Kettenbach) in maximum intercuspation (Fig 8).

The mini-implant analogs were placed in the impression, and the definitive cast was poured in stone (Dental Klasse 4 Primus, Klasse 4 Dental) and fixed with plaster (Arti STAR, Klasse 4 Dental) into a reline jig. In line with recommendations in the literature,10 a metal reinforcement was planned to stabilize the overdenture. The metal reinforcement was cast (remanium GM 380, Dentaurum) and positioned on the stone cast, and the denture was fixed into the counter-basis of the reline jig. Autopolymerizing polymethyl methacrylate (PMMA; Aesthetic Blue, Candulor) was used for the rebasing process and to pick up the housings. After polymerization, the palatal coverage of the denture was reduced to a horseshoe design and polished (Fig 9). The converted denture was delivered the day after impression-taking (Fig 10).

Clinically, the retention was evaluated, and it was decided together with the patient that the white retention inserts (very low retention) sufficed to provide a harmonious equilibrium between denture retention and easy denture removal (Fig 11). The occlusion was checked clinically and did not require any adjustment. A control visit 1 week after the denture delivery was scheduled; however, the patient cancelled the same day, as he experienced no sore spots. He communicated over the phone that he had already gained 2 lbs in body weight, and the overall experience was pleasant.

The patient was seen 2 weeks later during the patient’s visit to a dental hygienist. There were no sore spots or occlusal interferences detected, and the patient was happy with the outcome of the treatment. The implant at the maxillary right lateral incisor site had a probing depth of 4 mm and minor bleeding on probing. The other implants showed peri-implant probing depth of less than 4 mm and no bleeding on probing.
Fig 5  Postoperative frontal view of attachments 2 weeks post-implant placement.

Fig 6  Occlusal view of plastic impression trays after healing.

Fig 7  Complete denture with compound applied.

Fig 8  Definitive impression.

Fig 9  Processed denture with the housings picked up.

Fig 10  Frontal view of the denture at time of delivery.
Nine months after implant placement, some minor crestal bone loss was observed on the implant at the maxillary right lateral incisor site. The patient was seen for a 1-year follow-up and had no complaints. The soft tissues were observed to be healthy, and the prostheses were well-maintained (Fig 12).

DISCUSSION

This case report describes the use of a recently introduced one-piece mini-implant system with stud-type attachments to support the retention of a maxillary overdenture. This treatment option presents with lower morbidity and cost when compared to two-piece implant systems with a regular or narrow diameter.

Implant treatment of the edentulous maxilla has been historically known to be more challenging due to anatomical limitations (eg, the maxillary sinus) and lower bone quality compared to the edentulous mandible. In the last three decades, major advances in material and surface technologies have led to successful long-term outcomes with regular-diameter implants irrespective of the arch. Four implants with a regular diameter offer a well-documented solution for fixed or removable rehabilitation of the edentulous maxilla and may be immediately loaded if sufficient primary stability is achieved.

In the edentulous mandible, a two-implant–retained overdenture has been considered as the standard of care since the early 2000s. Mini-implants have a smaller total endosseous surface, and manufacturers recommend a minimum of four for removable rehabilitation of the edentulous mandible and six for the maxilla based on empirical observations. When using mini-implants, the maxilla also generally yields lower primary stability and allows immediate loading in less than half of the cases compared to the mandible. When treating the current patient, the insertion torque reached the threshold of 35 Ncm for none of the implants, and immediate loading was not considered, as recommended by the manufacturer’s instructions.

A flapless implant surgery for minimal morbidity is frequently advocated in combination with mini-implants and is usually preferred by patients. From a scientific perspective, this approach yields smaller risk for wound infection and postoperative bleeding, and patients are able to perform oral hygiene without interruption compared to flap elevation. The flapless procedure requires an adequate amount of keratinized mucosa and crest width and height that can tolerate potential surgical inaccuracies. Crest dimension is assessed preoperatively.
REFERENCES