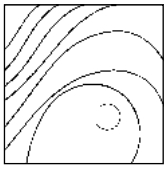
Immediate Rehabilitation of the Edentulous Mandible Using Ankylos SynCone Telescopic Copings and Intraoral Welding: A Pilot Study



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The aim of this prospective study was to assess the suitability of immediate rehabilitation of the edentulous mandible using SynCone copings and the intraoral welding technique. Patients with an edentulous mandible were fitted with a removable restoration supported by an intraorally welded titanium bar. Copings were connected to their respective SynCone 5-degree abutments and then welded to a titanium bar using an intraoral welding unit. This framework was used to support the definitive restoration, which was delivered on the day of implant placement. Restoration success and survival, implant success, and biologic or technical complications were assessed immediately after surgery and at 6 and 12 months. Twenty-two patients were consecutively treated with 88 immediately loaded implants. No acrylic resin fractures or radiographically detectable alterations of the welded frameworks were present in the 22 restorations delivered. One implant (1.1%) failed 1 month after surgery; all remaining implants (98.9%) were clinically stable at the 12-month follow-up. Within its limitations, this pilot study demonstrated that it is possible to successfully rehabilitate the edentulous mandible on the day of surgery with a definitive restoration supported by an intraorally welded titanium framework and SynCone 5-degree abutments. (Int J Periodontics Restorative Dent 2012;32:e189–e194.)

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The main distinguishing feature of the Ankylos SynCone system (Dentsply Friadent) is its implant abutment and gold or titanium coping. Because the implant has a morse taper connection, the SynCone abutment retains a full degree of rotational movement, so multiple units can be easily placed in parallel using different abutment angulations. Parallel placement is achieved using specific pins. The second distinguishing characteristic is the telescopic design of the coping, which is attached to the SynCone abutment without the use of any cement or a screw. These two features enable the restoring dentist to fabricate a restoration that is extremely stable and performs as well as a fixed restoration yet at the same time can be removed by the patient for daily maintenance.

In 2008, Zhang et al[1] assessed the long-term retentive characteristics of the SynCone system using an in vitro model. Eighteen 4-degree crowns and 18 6-degree crowns were tested over a 5,000 insertion-separation cycle using a 10-, 20-, and 30-N nominal insertion force.

The authors concluded that a constant retentive force could be expected over at least 5 years of use, calculated on the basis of thrice daily removal for cleaning.

In a recent case report on one patient, Huang and Zhu[2] examined immediate mandibular rehabilitation using the SynCone system. Provisional dentures were delivered immediately after placement of four intraforaminal implants and replaced by overdentures with casting frameworks after a maximum of 12 months. The authors reported no adverse events over a 12- to 24-month follow-up period, except for the early loss of a single implant 1 month after surgery. Eccellente et al[3] evaluated 39 patients with mandibular overdentures supported by the Ankylos SynCone system over a total observation period of 12 to 60 months. All patients were treated using the protocol of the manufacturer with pre-prepared dentures that were relined directly in the patients' mouths without the use of bar retainers. The implant survival rate was 98.7%, and the restoration survival rate was 100%. These figures suggest that the conical crown concept resulted in completely stable denture retention with a reduced denture base size and improved oral hygiene. However, the same authors reported 14 partial fractures of the denture base in 10 patients.[3]

In 2006, Degidi et al[4] published a protocol for the immediate loading of multiple implants by welding a premanufactured titanium bar to implant abutments directly in the oral cavity to create a customized metal-reinforced provisional restoration. The intraoral welding technique subsequently proved to be a successful option in the rehabilitation of the edentulous mandible, with a fixed definitive restoration delivered on the same day as implant placement using both butt-joint[5] and tapered[6] connection implants.

The aim of this pilot study was to assess the suitability of immediate rehabilitation of the edentulous mandible using the SynCone system and the intraoral welding technique.

Method and materials

Patients with mandibular complete edentulism who were 18 years of age or older were included in this study. State of the opposing dentition was not considered to be a discriminating factor. This study was designed and conducted in full accordance with the World Medical Association Declaration of Helsinki, as revised in 2002. All patients signed a specific written informed consent form. Each patient received four 3.5-mm-diameter square-threaded, grit-blasted, and acid-etched Ankylos implants with a tapered connection. Patients were not accepted into the study if they met any of the following exclusion criteria: *(1)* active infection in the sites intended for implant placement, *(2)* systemic disease that could compromise osseointegration, *(3)* treatment with radiation therapy in the craniofacial region within the previous 12 months, *(4)* smoking of more than 10 cigarettes per day, *(5)* current pregnancy or lactation, *(6)* noted bruxism, and *(7)* unsuitable bone quantity in the surgical site or need of bone augmentation procedures prior to implant placement. All implants were placed in healed sites by a single experienced surgeon in a private dental office in Bologna, Italy.

During implant placement, the insertion torque and implant stability quotient were recorded using a FRIOS Unit E surgical unit (W & H Dentalwerk) and an Osstell digital measurement probe (Osstell). Patients were excluded from the study if any of the implants had an insertion torque < 25 Ncm or an implant stability quotient of < 60.

Preoperative analysis of anatomical features was performed using panoramic radiography (Fig 1). Impressions were taken of the maxilla and mandible, and laboratory casts were made. The shades and molds for the prosthetic teeth were selected. Twelve Novo.lign (Bredent) commercial denture teeth were chosen, arranged on a cast mounted on a semiadjustable articulator, and joined with heat-polymerized resin.

Antimicrobial prophylaxis was obtained with the use of 500 mg beta-lactam amoxicillin (Pfizer) twice daily for 5 days starting 1 hour before surgery. Local anesthesia (4% articaine hydrochloride plus 1/100,000 adrenaline hydrochloride) was administered at the time of surgery. Surgery began with a

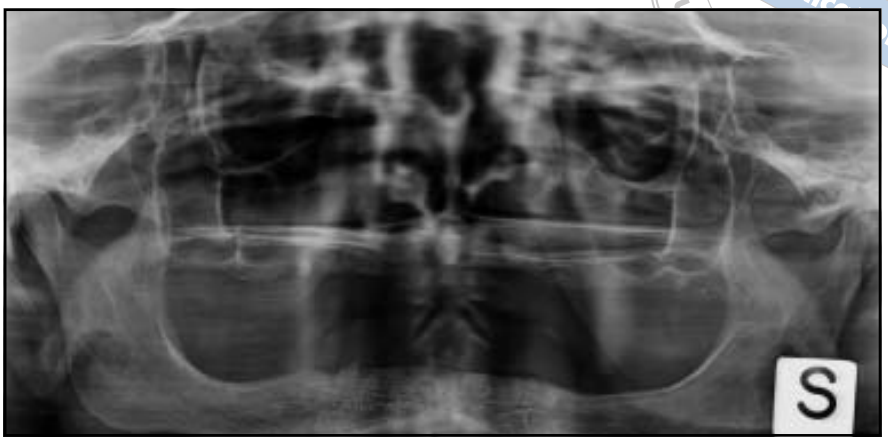


Fig 1 *Presurgical orthopantomogram.*

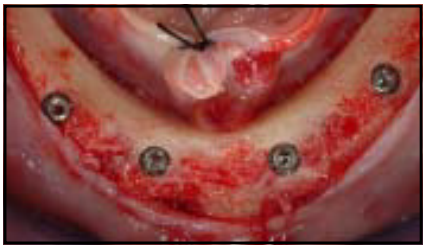


Fig 2 (left) *Four implants were placed in the intraforaminal region.*

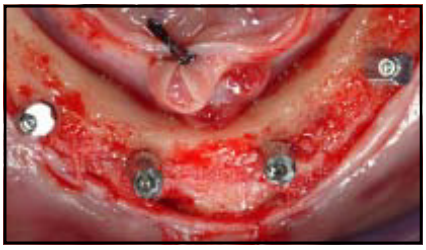


Fig 3 (right) *SynCone abutments connected to the implants.*

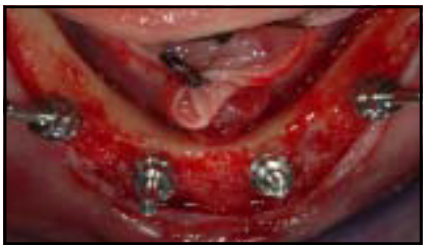
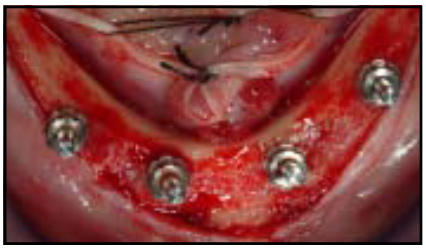


Fig 4a *Welding telescopic copings before alignment.*



Figs 4b and 4c *Welding telescopic copings after alignment.* (left) *Occlusal view;* (right) *frontal view.*

midcrestal incision; a full-thickness flap was then elevated, and the mental foramina were located. In cases involving a knife-edged ridge, mild osteoplasty of the ridge was performed under profuse irrigation with sterile saline solution. Four implant sites were chosen in the intraforaminal area: the distal sites were 2 mm from the mental nerve and the mesial sites equally divided the remaining anterior space (Fig 2). Definitive SynCone 5-degree abutments were then attached to the implants (Fig 3), made parallel with a Parallel Gauge (Dentsply Friadent) (Figs 4a to 4c), and screwed using a torque wrench (20-Ncm applied torque). Titanium conical caps were then placed over the definitive abutments, firmly engaged, and welded to a 2-mm-diameter bar made of commercially pure grade 2 titanium using the intraoral welding technique[6] (Fig 5). The prosthetic framework was removed, additional vertical titanium segments were welded to further support the teeth, and the passivity of the entire structure was checked (Fig 6). The titanium structure was sandblasted and opaqued using an OVS 2 Opaker (Dentsply Trubyte) (Fig 7). The soft tissue was positioned around the abutments and sutured into place. The restoration was sandblasted and prepared with Visio.link adhesive (Bredent). Novo.lign composite resin (Bredent) was then inserted into the hollowed restoration (Fig 8). The opaqued framework was repositioned in

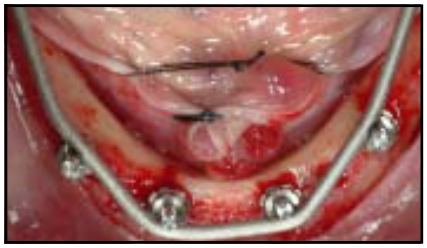


Fig 5 (left) *Intraorally welded framework.*

Fig 6 (right) *Extraoral addition of vertical titanium segments.*

Fig 7 *Opaqued framework repositioned in the oral cavity.*

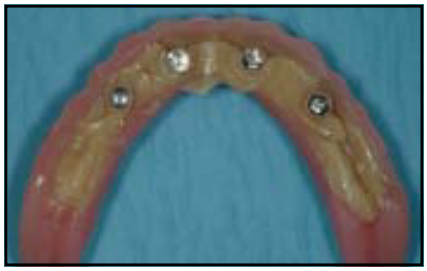


Fig 8 *Restoration removed after composite resin curing.*

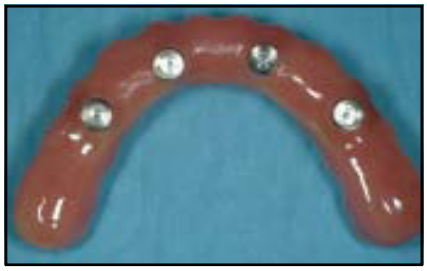
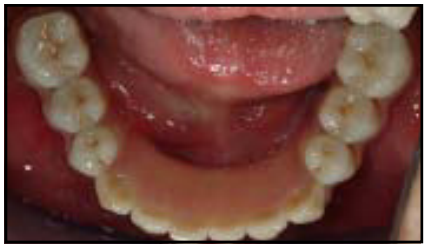


Fig 9 *Definitive restoration trimmed and polished.*



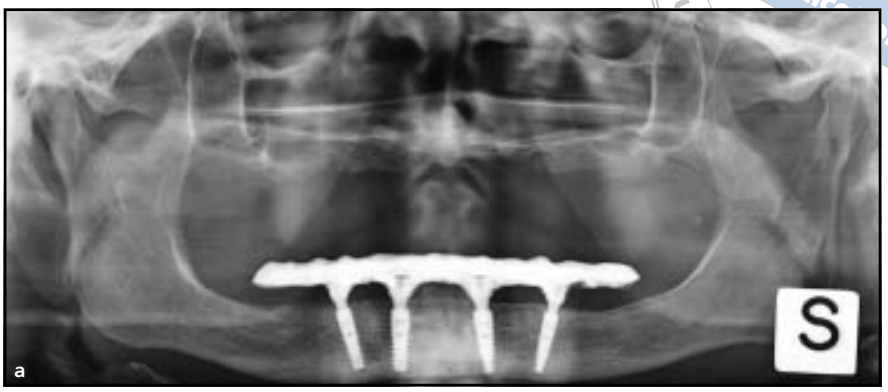
Figs 10a and 10b *Definitive restoration delivery.* (left) *Occlusal view;* (right) *frontal view.*

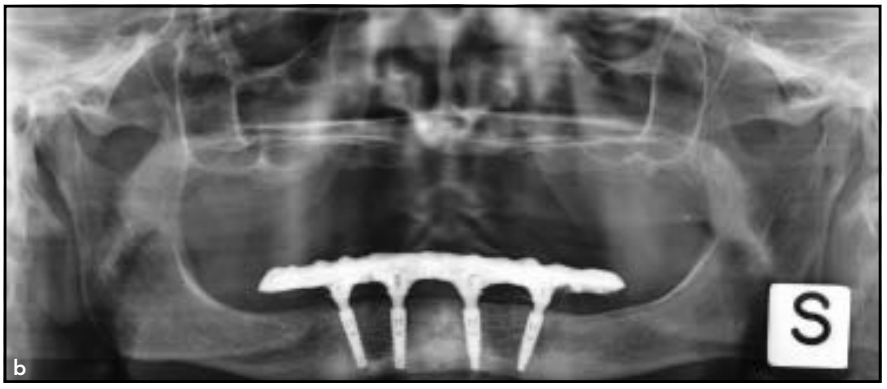
the oral cavity, the restoration was placed carefully over the framework, and the correct vertical height was checked and established using facial reference marks made prior to surgery. The composite resin was light cured to join the prosthetic shell and the framework. After setting, the prosthesis was removed and further packed extraorally with composite resin filling to complete the relining procedure. The restoration was then trimmed, polished, and delivered to the patient on the same day (Fig 9). The patient was instructed not to remove the restoration for 4 weeks, and oral hygiene instructions were provided. Since the restoration was only supported by implants, home maintenance was similar to that for a fixed prosthesis (Figs 10 and 11).

The following parameters were observed: restoration success (defined as absence of fractures in both the acrylic resin superstructure and the welding joints), restoration survival (defined as a prosthesis that is still functional after any repair procedure), implant survival (defined as absence of radiologic translucency, implant mobility, swelling, or pain in the surgical site at the time of follow-up examinations), and biologic or technical complications and any other adverse event. Patients were followed up with after surgery and fitting of the immediate definitive restoration and 6 and 12 months after surgery.

Results

A total of 24 patients were consecutively enrolled in this study between February and October 2009. Two patients were excluded because one or more of the implants they received failed to achieve the minimum planned insertion torque or implant stability quotient. Ten (45.4%) and 12 (54.6%) restorations were respectively placed in female





Figs 11a and 11b *Orthopantomograms taken* (a) *after surgery and* (b) *after 1 year of follow-up.*

Table 1 Mean bone quality values

	No. of implants	%
Type 1 bone	3	3.41
Type 2 bone	62	70.45
Type 3 bone	23	26.14
Type 4 bone	0	0.00

and male patients. The mean age of patients at the time of surgery was 55.2 ± 11.3 years. All restorations were placed in healed completely edentulous mandibles. The mean insertion torque value was 44.5 ± 12.1 Ncm, and the mean implant stability quotient was 79.1 ± 8.8. The mean values for bone quality at insertion sites are listed in Table 1. One patient (1.1%) reported substantial discomfort and pain 1 month after surgery. The restoration was subsequently removed, and 1 of the 4 implants, which was located in the right central incisor area, was found to be mobile. The implant was removed, and the prosthesis was carefully relined and modified. Pain was controlled with 1,000 mg of paracetamol taken twice daily for 5 days. The modified prosthesis was delivered to the patient 1 hour after implant removal. All remaining implants (98.9%) were clinically stable at the 12-month follow-up. No fractures or chipping of the acrylic resin and composite resin structure occurred. Since 1 prosthesis

(4.55%) needed repairs caused by an implant failure, the restorations in this study achieved a 95.45% success rate 1 year after surgery.

Discussion

The implants placed achieved a 98.9% survival rate 1 year after surgery. Only one implant failed in the very early phase of osseointegration. This result is in concordance with the assessments of Huang and Zhu[2] and Eccellente et al.[3] The analysis of the failed implant was unable to detect any element that could explain the failure. The patient, a 50-year-old woman who was in good general health, declared a smoking frequency of five cigarettes per day. She received four 14-mm-long implants, and her anamnesis was negative for periodontal diseases. Her opposing dentition was an implant-supported overdenture. The prosthesis was still in function at the 1-year follow-up, notwithstanding the loss of one implant 27 days after surgery.

Eccellente et al[3] reported 14 partial denture base fractures in 10 patients over a total observation period of 12 to 60 months. All patients were treated with a pre-prepared denture that was relined directly in the patients' mouths without the use of a bar retainer. It is possible that the acrylic resin structure of the restoration was too weak to withstand the full occlusal forces without the retainer. The restorations in this study achieved a 95.45% success rate 1 year after surgery. Although restorations manufactured using the intraoral welding technique are not immune to small fractures or acrylic resin chipping, as previously reported by Degidi et al,[5] this result is a notable improvement compared with results achieved using the protocol of the manufacturer, almost eliminating the principal flaw of the SynCone system. A significant reduction of deformation and strain within metal-reinforced restorations was already detected in a finite element analysis compared to acrylic resin superstructures.[4] The wide use of composite resin instead of traditional acrylic resin should also be mentioned as an important factor in reducing the incidence of fractures.

The 5-degree angulation of the telescopic crown in the SynCone system provides a balanced solution between the 4- and 6-degree crowns, enabling easier removal for daily cleaning while still retaining an adequate resistance to food adhesive forces. This, in addition to the greater flexibility granted to the restoring dentist by the intraoral welding approach (previously reported by Degidi et al[5]), allows the creation of an immediate and passively fitting restoration that is less expensive than one produced by other premanufactured framework procedures.[7,8]

Conclusions

Within its limitations, this pilot study demonstrated that it is possible to successfully rehabilitate the edentulous mandible with a definitive restoration supported by an intraorally welded titanium framework and SynCone 5-degree telescopic abutments on the same day as surgery. Further studies are required to verify the long-term effectiveness of this approach.

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