



## Immediate Implant Supported Full-Arch Restorations Fabricated with an Intraoral Welding Technique in Taiwan Patients with Intact Opposite Dentition-Case Series

Chienhai Li\*

Department of Dentistry, Chuan Sheng Dental Clinic, Hualien County, Taiwan

### Abstract

Twenty-two implants were placed in four Taiwan patients to support immediate full-arch restorations (one mandible and three maxilla) with intact opposite dentition. Passive-fit metal-reinforced frameworks were fabricated chairside by intraoral welding method, and all patients had definitive restorations on surgery day. All restorations were fabricated by screw-retained, implant-level components with full occlusal loading on the first day. Patients were recalled seven days, one month, three months and six months, with the follow-up period being over nine months until April 2016. All implants were osseointegrated, no infection was observed around the implants, and no fracture or cracking was found on the restorations. All patients were satisfied with the restorations.

**Keywords:** Intraoral welding; Immediate implant placement; Immediate loading; Full-Arch restoration; Rehabilitation

### Introduction

Intraoral welding technique is a time-efficient method to connect titanium implants and components, creating a metal reinforced framework immediately without the need for lengthy laboratory procedures. The two electrodes of the welding pincers are placed on either side of the wire and the abutment with firm pressure. When the procedure starts, electrical current instantly raises the temperature of the two titanium components to fusion point, joining the components together without the use of filler metal. The process takes only 2 milliseconds to 5 milliseconds to carry out and bring the core of the titanium parts to a temperature of nearly 1660°C. Due to the different thermal conductivity of the titanium parts (19) and copper electrodes (386), the copper electrodes dissipate all the heat that is generated, without damage to the surround tissue [1].

Degidi et al. [1] showed the intra-oral welded, screw-retained metal frameworks on Xive (Dentsply) implants at abutment level. The internal hexagonal connection of the implant was replaced by an abutment with an external circular and conic connection (MP; DENTSPLY-Friadent) to compensate for any possible lack of parallelism between the implants. The prefabricated dentures were relined intraorally with cold-cured acrylic and then removed from oral cavity and completely filled with heated pressure-processed acrylic. After the finishing process, the screw-retained restorations were delivered the same day. The long-term survival rate makes intraoral welding a predictable, reliable method to fabricate immediate temporary or permanent restorations [1-4]. There are several published articles, but patients are mostly European, and there are no Taiwan-based studies. The purpose of this article is to report the results of full-arch immediate restorations fabricated with intraoral welding technique in Taiwan patients with intact opposite dentition.

### Material and Methods

Four male patients were included in this case series. One patient was completely mandibular edentulous, and three were completely maxillary edentulous. The mean age was 66 years old (from 65 yr. to 67 yr.). All patients had at least ten teeth (natural teeth or implant supported restorations) on the opposite dentition with good biting force. All patients had the following criteria: (1) No systemic disease that could compromise osseointegration; (2) No active infection in the sites intended for implant placement; (3) No radiation therapy in the craniofacial region; (4) No bruxism; (5) No improper bone quality or quantity at the surgery site. All implants were placed by an experienced surgeon in a private dental clinic in Hualien, Taiwan. All implants were SLA surface, tapered design with a conical hex connection (SuperLine and Implantium, DENTIUM, KOREA).

### OPEN ACCESS

#### \*Correspondence:

Chienhai Li, Department of Dentistry,  
Chuan Sheng Dental Clinic,  
No.271, Sec.2 Jian Road, Jian  
Township, Hualien City, Taiwan, Tel:  
+88638530246; Fax: +88638514518;  
E-mail: unclehai@seed.net.tw

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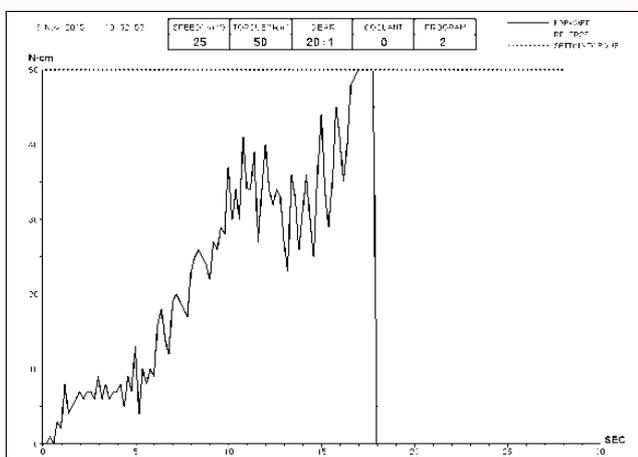
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**Table 1:** The torque force of twenty-two implants in four patients was recorded by the surgical unit.

Patient	Position(#)	Brand	Diameter	Length	Torque
Patient A	47	Super Line	45	10	50
Patient A	45	Super Line	40	10	50
Patient A	37	Super Line	45	10	50
Patient A	35	Super Line	40	10	50
Patient A	41	Super Line	40	10	48
Patient B	14	Super Line	40	12	50
Patient B	12	Super Line	40	12	50
Patient B	16	Super Line	45	8	50
Patient B	23	Super Line	45	12	50
Patient B	25	Super Line	45	12	50
Patient C	27	Implantium	48	12	24
Patient C	25	Implantium	48	8	50
Patient C	22	Implantium	43	14	50
Patient C	15	Implantium	43	12	50
Patient C	17	Implantium	48	10	15
Patient C	12	Implantium	43	10	45
Patient D	26	Implantium	43	10	50
Patient D	24	Implantium	43	10	50
Patient D	22	Implantium	38	10	35
Patient D	12	Implantium	38	10	50
Patient D	16	Implantium	43	8	42
Patient D	14	Implantium	38	10	38



**Figure 1:** The maximum torque force on the surgical unit was set at 50 N-cm.

Before surgery, all patients were checked by panoramic and CBCT image (CS 9300, Carestream Dental) including both dental arches. Impressions of both arches were taken by alginate, and the occlusal relationship recorded by silicone material. The plastic casts were mounted on a semi-adjustable articulator by face-bow transfer position, and eleven to fourteen composite resin denture teeth were arranged with bi-lateral balanced occlusion concept, and then joined with heat-polymerized resin. Patients received oral antibiotics (500 mg of amoxicillin) every 8 hours for 5 days, starting 1 hour before surgery.

Under aseptic conditions, local anaesthesia (2% lidocaine



**Figure 2:** Six implants placed and assembled with straight abutments, welded by 2 mm titanium wire in Patient C.



**Figure 3:** After welding, all screws were removed and the passive fit was checked by panoramic film.



**Figure 4:** Patient C, before surgery.

with 1:80,000 epinephrines, Dentsply Pharmaceuticals, USA) was administered, and the hopeless teeth were extracted followed by atraumatic procedures. If the implant needed to be placed in the fresh socket, the extraction socket was debrided until no soft tissue remained on the alveolar bone. The socket was then irrigated with normal saline solution (0.9% NaCl). The implant was placed 1 mm below mesial bone crest, and each patient accepted five to six implants in the arch with minimum flap elevation. No distal cantilever design was employed, and all restorations had implant support in the farthest posterior location. Implants were arranged parallel to each other as far as possible, and the Implant insertion torque was recorded by a surgical unit (Surgic Pro+, NSK, JAPAN) during each surgery (Figure 1 and Table1).

The internal conic connection abutments without hex (Dual Milling Abutment, Non-hex, DAB 45 156 NL) were assembled on all implants (with 25 N-cm torque force). The type 2 pure titanium wire (2 mm diameter) was bent to fit the arch form, and all abutments contacted the wire before the welding process. The main wire was welded by Weld One (DENTSPLY) machine about 3mm above the gum tissue, setting in "Smart High" program, and accessory wire was added between abutments to provide retention for restoration (Figure 2). After completing the welding process, all screws were removed and the framework was detached from the implants by a



Figure 5: Initial panoramic film of patient C before surgery.



Figure 6: Definitive full-arch prosthesis delivered on the surgery day in patient C.



Figure 7: Six months recall of patient C.

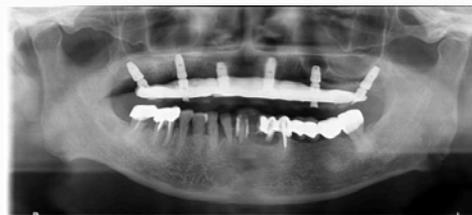


Figure 8: Six months recall panoramic film of patient C.



Figure 9: Patient C. The minor error of parallelism could be adjusted.



Figure 10: Patient C- The connection areas were adjusted to overcome the error of parallelism.

crown remover instrument. The excess parts of the framework were cut and sandblasted by sodium bicarbonate, and an acrylic resin based opaque layer (OVS II Opaker; Dentsply Trubyte, Youk, PA) was brushed onto the framework. Then the framework was placed onto the implants to check the passive-fit, all screws tightened to 25 N-cm, and then unscrewed, with all screws removed from the mouth, leaving the framework setting on the implants (Figure 3).

The inner acrylic material of the pre-fabricated complete denture was removed and checked intraorally to see if any interference would increase the vertical height or cause malocclusion. Complete dentures were relined intraorally by dual-cured pink composite resin (Bredent combo-lign gum) with the titanium framework, light cured and then trimmed, adjusted, and polished by an in-house lab technician. The screw holes were covered by light-cured composite resin after tightening the screw to 25 N-cm. The panoramic radiograph was taken after the delivery process to check the fitness between implants and abutments. All patients had full-arch fixed restorations in the same operation day with implant-level, screw type (25N-cm with torque wrench), fixed hybrid restorations (3 maxillary, 1 mandibular). The full-arch restorations received immediate functional loading, and patients were instructed to have a soft diet in the first month (Figure 4-6). Patients recalled the next day for occlusion check, and 7 days, one month, 3 months and 6 months after surgery (Figure 7 and 8). Every 6 months, the hybrid denture was removed for cleaning, and

inspected by naked eye for chipping or fracture. Panoramic and Periapical radiographs were performed to check the peri-implant bone level.

## Result

Twenty-two implants were placed in four patients (Table 1). Ten Super Line implants were placed in patients A & B, and twelve Implantium implants were placed in patients C & D. The mean implant size was 4.28 mm in diameter and 10.45 mm in length. The mean insertion torque of Super Line and Implantium was 49.8 N-cm, 41.6 N-cm, respectively. The mean follow-up time was 11 months (from 9 months to 14 months) until April 2016. No obvious peri-implant bone loss detected, and all implants survived and functioned well without peri-implantitis or soft tissue inflammation around the abutments resulting in a 100% survival rate. These fixed restorations were stable and the composite resin teeth showed no signs of chipping or cracking, and no fracture of denture base was detected. Patients reported no chewing soreness and all were satisfied with their restorations.

## Discussion

The residual bone height is less in Asian people therefore the average implant length in this report was 10.45 mm, shorter than the standard 11 mm- 15 mm length used by Degidi [1,5]. Two types of implants were used in this study, and all sequence followed the

implantation instruction by DENTIUM. The Super Line fixture group almost reached the maximum torque force set on the surgical unit (50 N-cm), but two Implantium fixtures did not reach 30 N-cm torque force. This difference may be due to the thread and taper design of the implant bodies [6].

The welding joint quality is the key point for long-term success. The DENTIUM abutment that used in this article had test extra-orally to verify strong connection with wire and didn't collapse during welding process. The restorations are implant-level full-mouth prostheses, without the angular screw abutment between restoration and fixture. This approach reduces the cost significantly [7], but the pathway tolerance is limited if the implants are not completely parallel to each other. In the case of minor divergence, the connection area of the abutments could be modified to eliminate the interference (Figure 9 and 10). Otherwise, the angled screw abutment with welding coping should be used to change the pathway [8,9]. The entire process, including passive-fit framework and definitive prosthesis, can be done in the clinic, instead of the outside laboratory. The titanium framework is soldered intraorally, avoiding the errors of conventional framework procedures during impression and lab fabrication. The composite resin is more rigid than common acrylic, and is easy to repair if chipping or cracking occurs [10]. The metal reinforced acrylic restoration can be modified chairside to adapt to soft tissue changes in the future [1,11].

## Conclusion

This article has demonstrated that the intraoral welding technique is a time-efficient method that could be successfully used to fabricate a passive-fit, implant-level fixed prosthesis for the maxillary or mandibular edentulous patient in Taiwan. Further studies should be undertaken to verify the long-term effectiveness of this approach.

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