Custom-made laser-welded titanium implant prosthetic abutment

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A technique to create an individually modified implant prosthetic abutment is described. An overcasting is waxed onto a machined titanium abutment, cast in titanium, and joined to it with laser welding. With the proposed technique, a custom-made titanium implant prosthetic abutment is created with adequate volume and contour of metal to support a screw-retained, metal-ceramic implant-supported crown.
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Titanium is the metal of choice for dental implants due to its biocompatibility[1] and superior physical and chemical properties, including adequate hardness and mechanical resistance, high surface energy, medium elastic modulus,[2] and relatively low density.[3] The use of titanium in implant-supported prostheses and implant abutments as a single metal avoids the risk of corrosion.[4]

Laser welding is a procedure to join parts made of the same alloy, versus other more traditional brazing procedures based on the use of a different alloy with a lower melting point to join the 2 parts. Furthermore, it is an ideal method for joining metals in dental prostheses because of its advantages as a clean, fast, and precise procedure.[5] Titanium is a metal that is well suited for laser welding.[6] Other advantages of laser welding are the versatility and flexibility to make modifications in implant abutments[7] and frameworks,[8-9] and the ability to add new components and repair fractured frameworks without the need for remanufacture.

A 46-year old woman presented with a congenitally missing left lateral maxillary incisor. A single implant (MicroMini Implant; 3i Implant Innovations Inc, Palm Beach Gardens, Fla) was placed, and after osseointegration, a single implant-supported crown with a modified titanium laser-welded implant abutment was fabricated. The purpose of this article is to illustrate the clinical and laboratory steps used with this procedure.

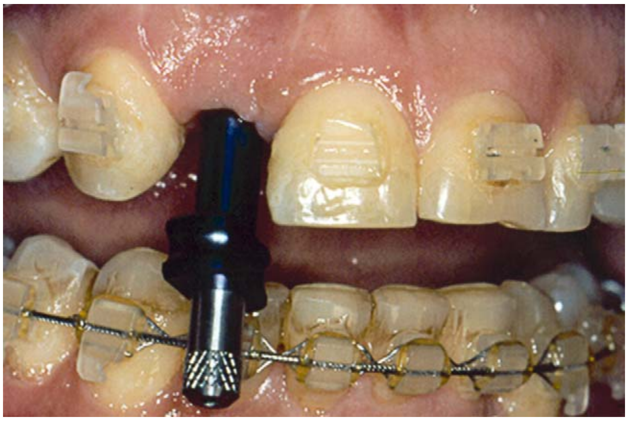

Fig 1. Facial view of transfer post prior to impression.

Fig 2. Proximal (*left*) and palatal (*right*) view of waxing (mirror view).

TECHNIQUE

1. Screw a transfer impression post (MEC33; 3i Implant Innovations Inc) onto the implant and make an impression with a custom-made open tray and heavy- and light-viscosity vinyl polysiloxane impression materials (Affinis; Coltene/Whaledent Inc, Cuyohoga Falls, Ohio) (Fig. 1).
2. Prepare a solid titanium abutment (Gingihue; 3i Implant Innovations Inc), reducing excess volume and height on the working cast.
3. Wax and increase the contour and volume required to obtain an improved esthetic result and necessary metal support for the ceramic material (Fig. 2).
4. Invest and cast the waxing in Type 2 titanium (Orotig grade 2; Orotig, Verona, Italy) (Fig. 3).
5. Preweld the overcasting (Titec 60L; Orotig) onto the abutment, using 2 initial laser welding points along the apical border on the lingual and buccal surfaces (Fig. 4).
6. Clinically evaluate the fit of the modified prewelded abutment (Fig. 5).
7. Completely weld the overcasting onto the abutment with overlapped welding points in the joint, and proceed with finishing and polishing the titanium metal

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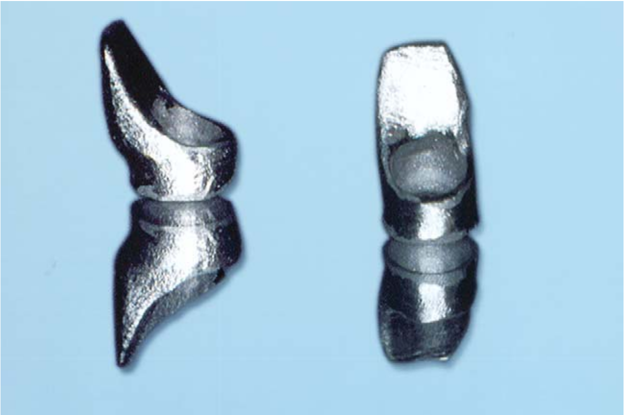

Fig 3. Proximal (*left*) and palatal (*right*) view of titanium casting (mirror view).

Fig 4. Facial (*left*) and palatal (*right*) view of cast titanium prewelded onto titanium solid abutment (gold-colored surface) (mirror view). Note ringed extension used to manipulate abutment during porcelain processing.

Fig 5. Clinical evaluation of prewelded abutment.

Fig 6. Definitive restoration.

with a wider laser point diameter and lower pulse energy.

8. Add the ceramic and evaluate the restoration clinically to ensure that an adequate metal-ceramic single-unit implant-supported crown has been fabricated (Fig. 6).

DISCUSSION

There are few implant abutments available for the restoration of narrow-diameter implants using titanium as the restorative metal. One option is to cast custom abutments, which may cause discrepancies or dimensional changes in the fitting surfaces. In the technique described, using the original titanium abutment maintains the precise fitting surface because the abutment is not introduced into a furnace that may cause thermal changes in the metal. The preweld provides a retrievable step, if change is necessary, because the cast titanium structure can be unwelded, modified, and rewelded, and the original titanium abutment is not lost in the event of failure.

SUMMARY

Laser welding is a versatile technique to modify implant abutments. A cast titanium fragment can be easily added to a premachined titanium abutment.

Thus, optimal functional and esthetic results can be achieved with laser welding, respecting the morphology of the fitting surface and using the parent metal of the original abutment.

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Noteworthy Abstracts of the Current Literature

5-year follow-up of a prospective clinical study on various types of core restorations

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Purpose: This study tested whether: (1) the survival rate of cast post-and-core restorations is better than the survival of direct post-and-core restorations and post-free all-composite cores; and (2) the survival of these buildup restorations is influenced by the remaining dentin height after preparation.
Materials and Methods: In a clinical trial, 18 operators made 319 core restorations in 249 patients. The restorations involved were: (1) cast post-and-core restorations; (2) direct post and composite core restorations; and (3) post-free all-composite cores. All restorations were made under single porcelain-fused-to-metal crowns. Treatments were allocated after dentin height assessment using balanced drawing. Failures were registered during a 5-year period.
Results: Fifteen restorations failed during the follow-up period. Five failures occurred during the first month; they were considered to be independent from clinical aging and excluded from further survival assessments. The overall survival was 96% ± 2%. No difference was found between the survivals of the different types of restorations. The factor ‘‘remaining dentin height’’ appeared to have a significant effect on the survival of post-and-core restorations (98% ± 2% survival for ‘‘substantial dentin height’’ vs 93% ± 3% for ‘‘minimal dentin height’’).
Conclusion: The type of post and core was not relevant with respect to survival. The amount of remaining dentin height after preparation influenced the longevity of a post-and-core restoration.—*Reprinted with permission of Quintessence Publishing.*