Intraoral Luting: Modified Prosthetic Design to Achieve Passivity, Precision of Fit, and Esthetics for a Cement-Retained, Implant-Supported Metal-Resin-Fixed Complete Denture

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Abstract

An intraoral luting technique between electroformed gold copings and a metallic framework for a cement-retained, implant-supported metal-resin-fixed complete-denture is presented. The peculiarity is the different prosthetic design with the metallic framework that was 1.5 mm shorter than the margin of the electroformed copings. As a consequence, the conventional thick prosthesis margin (electroformed copings, cement for the luting phase, framework) was modified into a thin electroformed prosthesis seal (0.3 mm) just beyond the apical limit of the esthetic material. Passive fit between the framework and the electroformed gold copings was achieved during the intraoral luting phase. The procedure was efficient and standardized and enhanced esthetics.

This report describes a technique for the intraoral luting of electroformed gold copings[1] to achieve passive fit and to enhance esthetics for a cement-retained, implant-supported, metal-resin-fixed complete-denture (CIMC).[2] As no studies reported to date provide an unequivocal definition of the level of tolerance of inaccuracy in the framework of such a denture,[3,4] passive fit remains the primary goal of implant prosthetic protocols to guarantee long-lasting osseointegration and mechanical stability.[5] Because the number of technical steps and the intrinsic properties of the materials may result in distortion,[6–8] various procedures have been developed to minimize prosthetic misfit and stress transfer at the bone-implant interface. These include casting the framework,[9–12] spark erosion,[13] the Cresco system,[14] soldering,[15,16] computer numeric-controlled milling technique,[17] verification indices and casts,[18] management of impressions,[19,20] and investing and veneering.[21] The introduction of the intraoral luting phase reduces the number of material distortions and operator errors.[21–25]

In the procedure to be described here, a CIMC was fabricated. A precise fit was achieved through the use of electroformed gold copings and passivity through an intraoral luting sequence between a metallic framework and the electroformed gold copings. The metallic framework was 1.5 mm shorter than the margin of the electroformed gold copings. As a consequence, in the area next to the free gingival margin, the presence of a thick prosthesis margin composed of the electroformed copings, the layer of cement (for the luting phase), the metallic framework, and the esthetic veneering were eliminated. The prosthesis seal was guaranteed only by the electroformed gold coping, just beyond the apical limit of the esthetic material.

The procedure began with an impression of the position of the fixtures taken using the pick-up technique. An individual tray with openings at the implant sites was used, and the transfers were fixed to the tray with an autopolymerizing resin (Futura Lay P, Schütz-Dental GmbH, Rosbach, Germany). Master casts were poured with type 4 dental stone (Fujirock, GC Europe Interleuvenlaan Leuven, Belgium). Peri-implant soft tissues were reproduced with pink silicone (Gingifast Rigid, Zhermack, Badia Polesine, Italy). The definitive casts were mounted in a semi-adjustable articulator (Artex, Girrbach Dental GmbH, Pforzheim, Germany).

Technique

First laboratory session

1. To simulate the definitive prosthesis design, mold a diagnostic tooth arrangement in wax (Flex-EZ-Wachs F-54 G, Coltène/Whaledent S.à.r.l., Le Mans, France).
2. To obtain a template of the position of the teeth, make a silicone (Silco MS extrahard, Simed srl, Milan, Italy) index of the tooth arrangement in wax.
3. Choose the titanium abutments (GingiHue abutment, BIOMET 3i, Palm Beach Gardens, FL) in relation to the height of the peri-implant soft tissues and to the previously described silicone template (step 2) (Fig 1).
4. Control the height and the parallelism of the abutments with a surveyor (Fresart, Artiglio, Parma, Italy), milling if necessary, using the previously described silicone template (step 2) as a reference.
5. Make a positioning template for the abutments with autopolymerizing resin (Pikuplast, Bredent, Senden, Germany). Place resin in the interproximal spaces between the abutments and prepare two resin walls (one vestibular, one lingual) to contact the abutments. Finally, obtain a resin structure that surrounds the abutments and allows occlusal access for the abutment screws.
6. Fabricate the interim cement-retained, implant-supported complete denture with autopolymerizing resin (Sintodent, Sintodent srl, Rome, Italy), using the previously described silicone template (step 2).
7. Screw the milled abutments to the implant laboratory analogs and prepare them for making the electroformed gold copings.
8. Fabricate the electroformed gold copings with a 0.3 mm thickness directly on the abutments.
9. Position the milled abutments onto the definitive cast, then position the electroformed gold copings onto the abutments.
10. Treat the electroformed gold copings with the spacing liner (Tru-fit, Geo. Taub Prod and Fusion Co Inc, Jersey City, NJ) to provide the necessary space for the luting agent.

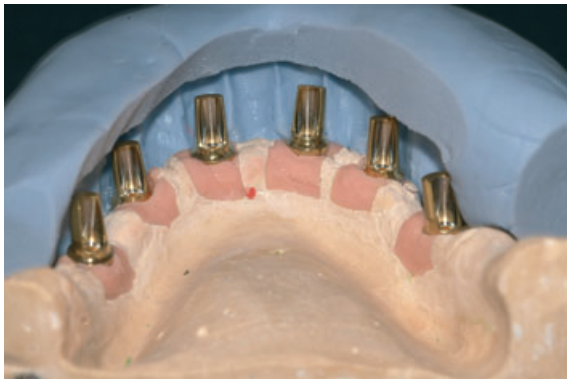

Figure 1 Select the GingiHue titanium abutments controlling height, parallelism, and relation with peri-implant soft tissues. Use a silicon index to guide fabrication of the definitive prosthesis.

Figure 2 Closer view of the relation between the metallic framework and the electroformed gold copings.

11. Mold the framework using wax (Flex wax, Micerium srl, Genova, Italy). The margin of the framework must be 1.5 mm shorter than the marginal seal of the electroformed gold copings (Fig 2). Use the previously described silicone template (step 2) to ensure that the framework allows adequate space for teeth.
12. Cast the framework in grade 4 titanium (wt%: N_2 0.05, O_2 0.40, H_2 0.015, C 0.10, Fe 0.40, Ti 98.9375, Bio Ti, Austenal Inc., Chicago, IL).
13. Check the passivity of the framework on the electroformed gold copings placed onto the abutments.
14. Using airborne particles, abrade the framework and the electroformed gold copings to roughen the mating contact surfaces.

In the steps described above, the technician fabricates the abutments, the interim cement-retained, implant-supported complete denture, the electroformed gold copings, and the framework in one laboratory session.

First clinical session

1. Using the previously described positioning template (first lab session, step 5) and the manufacturer's recommended torque, position and screw the abutments into the patient's mouth.
2. Position the electroformed gold copings onto abutments, checking the position and fit of the abutments and electroformed gold copings on radiographs (Fig 3).
3. Check the framework, verifying stability and passivity. If the structure is not completely passive, use the fit-indicating spray (Spy Spray, Apex Dental srl; Milan, Italy), and correct the structure to ensure passivity.
4. Lute the framework onto the electroformed gold copings with a composite luting agent (Nimetic cem, 3M ESPE, Seefeld, Germany) (Fig 4).
5. After 6-minute polymerization time, remove the luted structure (framework + electroformed gold copings) from the patient's mouth and remove excess cement with sharp instruments.

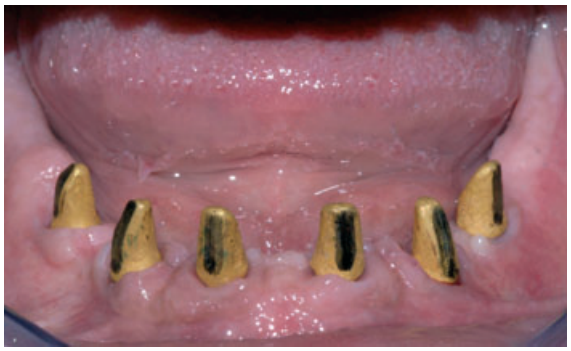

Figure 3 Position electroformed gold copings onto milled abutments.

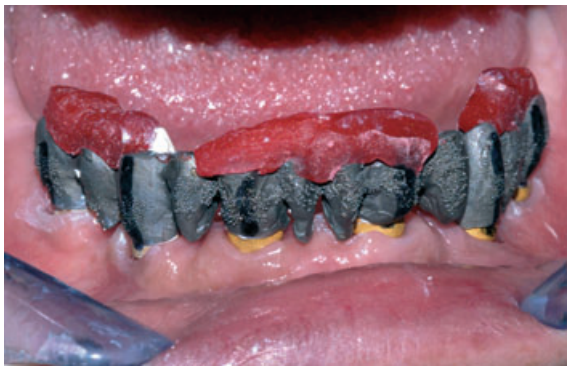

Figure 4 Lute metallic framework onto electroformed gold copings directly in mouth.

6. Position the luted structure in the patient's mouth.
7. Using an autopolymerizing resin (Futura Lay P), record the maxillomandibular relation.
8. Make a positioning impression of the luted structure with a medium viscosity polyether (Impregum Penta, 3M ESPE, Seefeld, Germany) to reproduce the soft tissues on the cast.

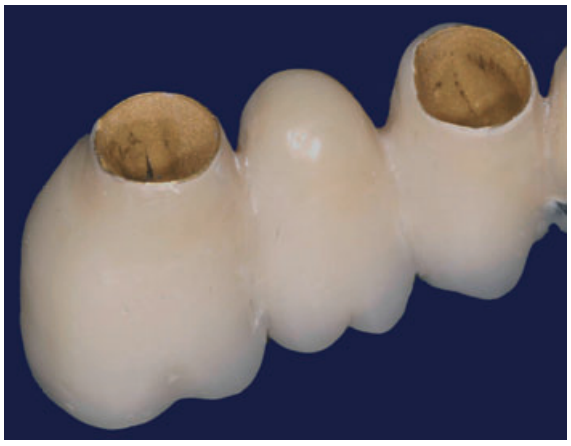

Figure 5 In the definitive prosthesis, only the margin of the electroformed gold copings guarantees precision of seal.

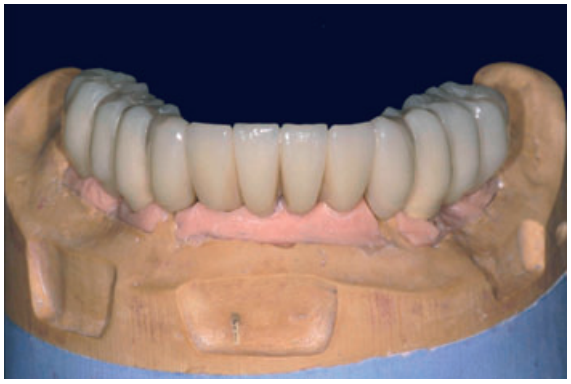

Figure 6 Definitive cement-retained, implant-supported metal-resin-fixed complete denture (CIMC) before delivery to patient.

9. Deliver the provisional cement-retained, implant-supported complete denture to the patient, placing it onto the previously positioned abutments (described in step 1).

Second laboratory session

1. Mount the new cast in a semi-adjustable articulator (Artex, Girrbach Dental GmbH) using the previously recorded maxillomandibular relation (first clinical session, step 7).
2. Check the luted structure with an operative microscope (20×), removing excess cement with sharp manual instruments and small burs.
3. Complete the esthetic veneering with a hybrid ceramic (Estenia, Kuraray Medical Inc, Okayama, Japan) (Fig 5).

Second clinical session

1. Remove the interim cement-retained, implant-supported complete denture from the patient's mouth.
2. Evaluate the esthetics and occlusion of the definitive CIMC.
3. Return the interim cement-retained, implant-supported complete denture to the patient.

Third laboratory session

Refine and polish the definitive CIMC using polishing compound, polishing brushes, and felt wheels (Estenia) (Fig 6).

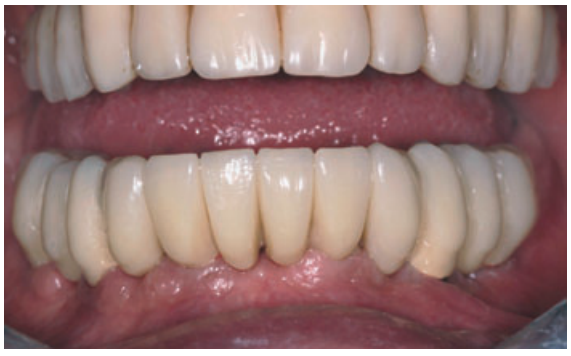

Figure 7 Definitive CIMC in patient's mouth.

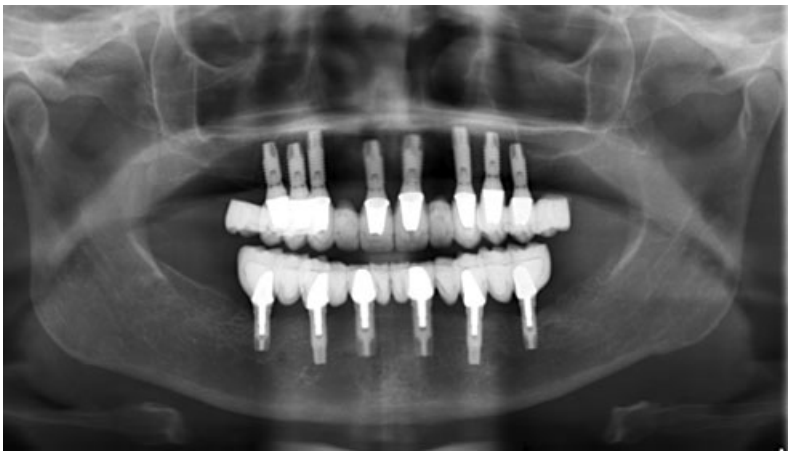

Figure 8 Final radiographic evaluation.

Third clinical session

1. Remove the interim cement-retained, implant-supported complete denture from the patient's mouth.
2. Deliver the definitive CIMC using resin cement (Cem-Implant, BJM Laboratories Ltd, Hassadna St. Industrial Park, Israel) to cement the prosthesis onto the abutments (Figs 7 and 8).

Discussion

This technique allows the achievement of precision, passivity, and esthetics with a reduction of working time. The technique's unique feature is the reduction of the conventional thick prosthesis margin (electroformed gold coping, cement for the luting phase, conventional framework) to a thin electroformed prosthesis seal (0.3 mm) just beyond the apical limit of the esthetic material. Moreover, a good chromatic camouflage in the area next to the free gingival margin is obtained.

The technique has the advantage that it can be performed with all implant systems with milling abutments. The clinician and the technician can choose the metal for casting the framework, and the esthetic resin veneering material. The electroformed gold copings are made directly on these milled abutments. In particular, grade 4 titanium offers many advantages including better biocompatibility and the reduction of the incidence of allergic phenomena. Nobel metal frameworks can be used, but are more expensive. Moreover, they have a lower resistance and should be made with a higher volume and weight.

One disadvantage is the composite luting agent (Nimetic cem) used to intraorally lute the electroformed gold copings to the metallic framework. This agent does not resist above 120°C. For this reason, the esthetic veneering was made with hybrid ceramic (Estenia). In the future, the development of luting materials that resist at the temperature for low-fusing porcelains should overcome this limit. The procedure presented is repeatable and ensures a passive prosthetic rehabilitation with a thin prosthesis seal and a highly esthetic result.

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