Passive Fit Frameworks - the CAL-Technique™

The importance of an accurate “passive” fit between frameworks and implant abutments has long been acknowledged. The ankylosed nature of implants does not allow for fit discrepancies of screw retained restorations. A non-passive fit transfers vertical and lateral stresses to the implants and restorative components and may be responsible for loss of osseointegration and/or component loosening or failure. Fig. 1

A space of 30 microns or less over 10% of the interface of the casting and abutment can be considered an acceptable range for an accurate fit. Standard clinical and laboratory techniques do not provide a cast framework with this degree of accuracy because of the properties of the materials.

Many factors are responsible for the inaccurate fit seen clinically with frameworks fabricated with standard laboratory procedures:

- Inconsistent linear expansion of impression materials
- Distortion/shrinkage of impression trays
- Expansion of gypsum model and die materials
- Distortion of wax/plastic bar patterns
- Dimensional discrepancies in investment material
- Shrinkage in metal mass during solidification

A marginal discrepancy over an implant site will create tension on the intermediate components as well as the implants. Fig. 2

The traditional technique of cutting and soldering non-passive frameworks often does not consistently result in an acceptable fit.

Newer techniques such as Electrodischarge Machining (EDM), also called Spark Erosion, can only create a passive fit to a model and does not guarantee a passive fit intraorally. The EDM process can also adversely affect the screw access hole. ■

The ’CAL-Technique™

The CAL-Technique (California Abutment Luting) was developed in 1992 by Helmut Grigereit, formerly with Heraeus Kulzer, in conjunction with Attachments International, Inc. The CAL-Technique provides a consistent means for achieving passive fits for overdenture and fixed-detachable frameworks.

- The CAL-Technique eliminates the need for cutting and soldering the cast framework.

The CAL-Technique utilizes advanced adhesion technology to bond pre-machined titanium cylinders to a cast framework. The framework is made utilizing temporary shim spacers which provide a limited symmetrical space between the casting and the titanium CAL cylinders. This space is later filled intraorally with a dual-cure composite resin such as Twin Look from Heraeus Kulzer.

The adjoining surfaces of the titanium CAL cylinders and the cast framework are silicoated before intraoral luting to create an extremely strong bond. Figs. 3A & 3B. The intimate bond created between the silicoated titanium cylinders and framework is in the range of 8,000 to 10,000 psi.

Other systems for bonding metal to metal are also available.

The components for the CAL system are available exclusively from Attachments International for the UMA Abutment and the Branemark Standard Abutment.


References

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CAL-Technique formerly called the KAL-Technique

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Standard impression and model fabrication procedures are utilized with the CAL-Technique. A standard wax set-up and silicone matrix should be performed before the initial bar pattern is constructed. The CAL cylinder assemblies are attached to the abutment analogs in the model. Fig. 4

The CAL plastic cylinders with spacers in place are joined with the bar patterns Fig. 5. The spacers are discarded and the bar/framework pattern is cast. The internal aspect of the cast bar and the external aspect of the titanium CAL cylinders are sandblasted with 250 micron aluminum oxide, then silicoated and opaqued following Kulzer’s recommended procedures. Figs. 6 & 7

At chairside, the silicoated interfaces should first be cleaned with acetone. The fixation screws are placed into the titanium CAL cylinders and plastic handles (occlusal plugs) are inserted. The luting composite is applied to the external aspect of the silicoated CAL cylinders and the internal aspect of the cast bar Figs. 8 & 9. The CAL cylinders are inserted into the framework and the assembled framework is placed intraorally onto the implant abutments. NOTE: No more than three sites should be attempted at one time.

The plastic handles (occlusal plugs) are removed and the fixation screws are tightened. A four handed technique is used to evenly stabilize the framework while each site is photo-cured for approximately 8 seconds.

Figs. 10 & 11. The luting material is then allowed to auto-cure for an additional 8 minutes before the luted framework is removed. The remaining sites are cured similarly.

The passive fit framework, however, may not fit the original model after intraoral luting. It may be necessary to take a pick-up impression of the luted framework for a new master model. The acrylic is then processed on the new processing model.

Protective polishing caps are attached to the fitting surface of the assembled framework before the excess luting resin is removed Figs. 12 & 13. The assembled framework is then finished and polished taking care not to over heat the framework.

Close inspection verifies the

Acknowledgements
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Bob Clark, CDT
Williams Dental Lab
Gilroy, CA

Products referenced
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The CAL-Technique can be used to create passive fit frameworks for fixed-detachable hybrid denture frameworks. The considerable mass of this type of framework makes it especially difficult to achieve a passive fit using conventional techniques. A pre-made rim called the PC Wafer can be used to form the hybrid denture framework. Once cast, the CAL cylinders are luted intraorally to the framework.

The translucent PC Wafer is positioned over the model and the outline of the arch is drawn with a marking pin Fig. 15. The wafer is then reduced with a lathe and the positions of the abutments are marked on the wafer. Holes are made in the marked sites and the wafer is trimmed as desired Fig. 16. Any voids between the PC Wafer and the CAL spacers may be filled in with light-cure resin, cyanoacrylate, or wax Fig. 17. The Framework should not impinge on the retromolar pad and the lingual should be contoured to facilitate hygiene Figs. 18 & 19. A silicone index may be used as a guide to verify contours and retention beads or rods as desired Fig. 20.

The CAL spacers are removed and the pattern is cast in a hard precious or semi-precious alloy Fig. 21. The casting is finished, sandblasted with 250-Micron Al Oxide and silicoated following manufacturer’s recommendations. The external surface of the titanium CAL cylinders are sandblasted and silicoated. Fig. 22

At chairside, the silicoated titanium CAL cylinders are inserted into the silicoated framework. The luting composite is applied to the external aspect of the silicoated CAL cylinders and the internal aspect of the cast bar Fig. 23. The CAL cylinders are inserted into the framework and the assembled framework is placed intraorally onto the implant abutments.

NOTE: No more than three sites should be luted at one time.

The plastic handles (ocular plugs) are removed and the fixation screws are tightened. A four handed technique is used to evenly stabilize the framework while each site is photo-cured for approximately 8 seconds. The luting material is then allowed to auto-cure for an additional 8 minutes before the luted framework is removed. The remaining sites are cured similarly.

The passive fit framework, however, may not fit the original model after intraoral luting. It may then necessary to take a pick-up impression of the luted framework for a new master model.

Protective polishing caps are attached to the fitting surface of the assembled framework before the excess luting resin is removed. The assembled framework is then finished and polished taking care not to over heat the framework.

The acrylic is then processed on the new processing model. Fig. 24

Acknowledgements
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Products referenced

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Louis Girard of the University of Bordeaux discovered an iron implant/tooth in a skeleton, approximately 1900 years old, unearthed from an ancient cemetery at Chantabre, about 60 miles south of Paris.

X-rays reveal that the iron implant/tooth fitted perfectly into the socket and that the bone had grown around the artificial root. This suggests that the tooth/implant was modeled from the lost natural tooth. This allowed the tooth/implant to be gently placed in to the socket. X-rays show that there was no destruction to the socket.

How the ancient implantologist acquired such skill or prevented infection is not known.

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