Conversion of Acrylic Hybrid Dentures to Monophase Zirconia Bridge

Michael Tischler DDS, José Echeverry CDT, Darwin Bagley CDT

Hybrid Denture bridges have a well-documented history greater than 40 years as a successful treatment modality.[1] Recent years have seen a dramatic increase in their usage.

Hybrid denture bridges have traditionally been comprised of acrylic denture teeth and acrylic PPM resin processed around a screw-retained metal substructure, hence the name "hybrid denture bridge". While this traditional design has been successful, it is well known that the acrylic denture teeth are highly susceptible to breakage and occlusal abrasion. Figs. 1 & 2

In his article, "Maintenance of Implant Hybrid Prostheses: Clinical and Laboratory Procedures",[2] Carl Drago DDS states "conventional acrylic resin denture teeth have a life expectancy of approximately 7 to 9 years prior to needing replacement." Once acrylic denture teeth have reached a significant level of abrasion the restoration needs to be remade or new denture teeth and acrylic needs to be reprocessed over the existing metal framework. A significant rate of tooth wear and acrylic fracture of acrylic hybrids was also documented in a study by Theodora Bozini DDS, published in 2011.[3]

Fig. 1 Breakage of acrylic denture teeth

In recent years a solution to this maintenance problem has been found in Monophase zirconia. Zirconia is a mineral composed of the element zirconium, silicon and oxygen. Zirconia used in dentistry is actually zirconium dioxide partially stabilized by yttrium and enriched with aluminum. This results in an exceptional material with a high flexural strength greater than 1400 Mpa.[4]

Fig. 2 Occlusal abrasion and breakage of acrylic denture teeth

The newest available zirconia is highly translucent and when used with specialized coloring stains, the need for veneering porcelains in areas of occlusal load is entirely eliminated.

All functional areas are maintained as solid Prettau® zirconia.

When restoring lighter tooth shades (bleached shades through A-1), veneering porcelain is not required facially. For darker tooth shades, minimal cut-back can be performed and porcelain can be added facially in those non-functional areas. Tissue shaded porcelains also are added gingivally not affecting functional zones. This concept results in all functional zones to be comprised of Monophase zirconia not susceptible to wear, chipping or breakage.

Fig. 3 Existing acrylic hybrid denture

This article will detail how to work in conjunction with a zirconia specialty laboratory to convert a traditional or provisional hybrid denture into a Monophase zirconia bridge.

It is essential that the acrylic hybrid to be converted fits passively to the existing implants / abutments and that the tooth arrangement has been esthetically and functionally verified by the restoring dentist and the patient.

The existing acrylic hybrid denture is inserted gingivally into PVS lab putty capturing the intaglio / gingival and abutment /implant interfaces. A wide circumference of putty is required for stability. While the putty is still moldable, small indentations are made to index later with covering putty. Figs. 3 & 4

Fig. 4 Intaglio aspect emerged in putty

Once the initial putty has set, silicone separator is applied and the top putty section of the mold is intimately formed capturing the teeth and the remaining gingival areas. Fig. 5

Fig. 5 Top putty mold is formed

Once the top putty portion has set, the mold is separated and the acrylic hybrid denture bridge is removed. Fig. 6

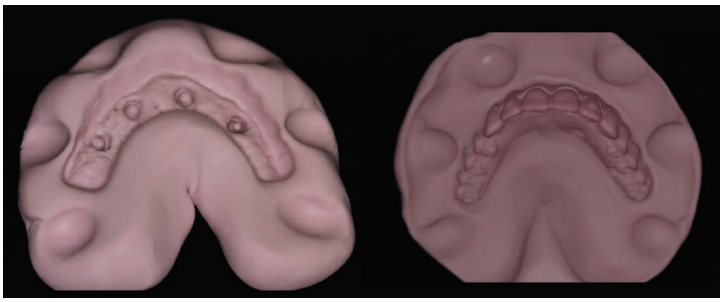


Fig. 6 Bottom and top portions of the PVS putty mold of the acrylic hybrid denture bridge.

The complete putty mold along with the articulator, mounted with a master model with abutment analogs and bite registration, are sent to the zirconia specialty laboratory. A facebow may also be included.

The zirconia specialty lab will fabricate a resin duplicate of the acrylic hybrid denture. Fig. 7

Fig. 7 Resin duplicate of acrylic hybrid denture

Fig. 8 The resin duplicate is articulated.

The resin duplicate is articulated, scanned and imported into the CAD design program to mill the design for the zirconia hybrid bridge. Figs. 8 & 9.

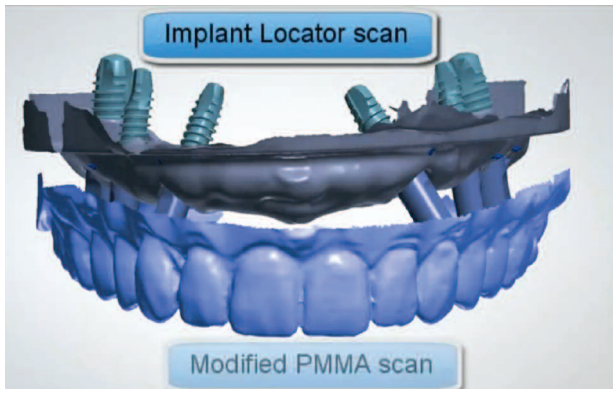


Fig. 9 Combined Scans of implant location, soft tissue and resin duplicate

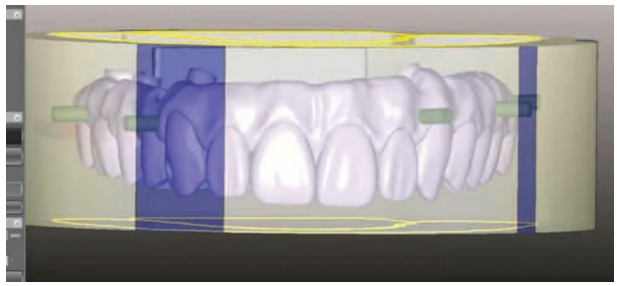


Fig. 10 Virtual design of duplicate in virtual zirconia block

The design software shows a preview of the zirconia bridge in the zirconia block. Fig. 10

Option: The restoring dentist may scan the acrylic hybrid denture on the model and send the open source STL file to the zirconia specialty laboratory. This would negate the need for the putty mold of the acrylic hybrid.

Fig. 11 Zirconia bridge milled from block

The zirconia design is milled in the zirconia block. Figs. 11 & 12

Fig. 12 Initial milled zirconia bridge removed from CAD/CAM milling machine

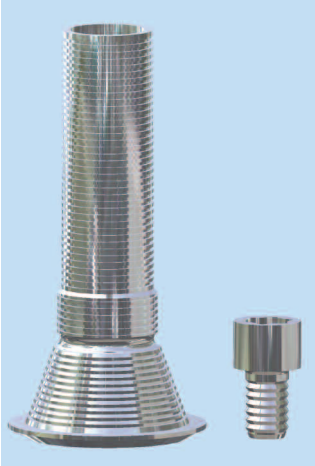


Fig. 13 CAL® titanium cylinder and screw for Multi-Unit Abutment®

Space to receive non-engaging titanium interfaces is programmed into the access channels and mating surfaces of the zirconia bridge. CAL® cylinders for the Multi-Unit® abutments are utilized in this example.

The titanium CAL® cylinders provide a metal seat for the implant abutment interface and screw seat. The CAL® concept also creates a passive fit once they are cemented into the finalized zirconia bridge on the master model or intra-orally. Figs. 13 & 14

Fig. 14 Mating surface of CAL® titanium cylinder shown in sintered zirconia bridge

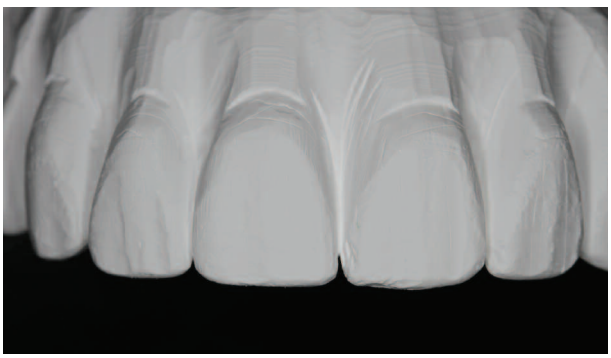


Fig. 15 Facial anatomy is sharpened and gingival is cut back.

Fig. 16 Coloring liquids (stains) are applied prior to sintering.

Sharper definition is prepared and the gingival areas of the zirconia bridge are sculpted back to later receive tissue shaded porcelain. Fig. 15

Special shading color liquid stains are applied (infiltration) prior to the sintering process. Figs. 16 & 17

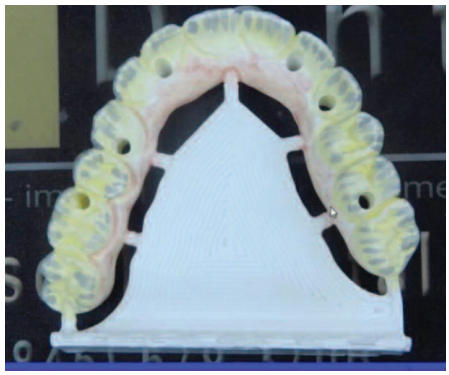


Fig. 17 Shading color liquids (stains) are applied occlusally and lingually.

Fig. 18 Sintered zirconia bridge removed from furnace.

The shaded zirconia bridge is then sintered for 11-12 hours in a finely controlled furnace at 1500ºC. "Sintering" is the term used to describe the crucial finely controlled heating and cooling process that in this case causes 20% volumetric shrinkage. This material compaction results in a zirconia that is incredibly dense, strong and smooth. Fig 18

Fig. 19 Tissue colored porcelain applied gingivally

Following the sintering procedure, tissue colored porcelain is applied to the gingival areas. Custom tissue color shade guides are utilized at chair-side to match the patient's natural gingival colorization. It is recommended for the Doctor to take an intra-oral photo with the closest matching tissue shade guides next to the patient's gingiva. This photo aids the ceramist applying the gingival colored porcelain to create the most realist effect.

This gingival colored porcelain is specially formulated with a thermal expansion coefficient value of 9.6., matching that of the zirconia, creating a strong bond and preventing cracks. Fig. 19

Fig. 20 Left side stained and glazed

Fig. 21 Definitive restoration palatal view

Fig. 22 Final staining and gingival colorization creates a natural appearance - occlusal view.

The porcelain is fired, polished and glazed following the manufacturer's recommendations.

It is very important to create a highly polished and smooth surface on the zirconia to prevent excessive abrasion of the opposing teeth. Figs. 20 - 22

Once the polishing and glazing are finalized, the metal interfaces (CAL® cylinders) are cemented in place with a composite resin cement while attached to the master model, in occlusion while on the articulator. Figs. 23 - 25

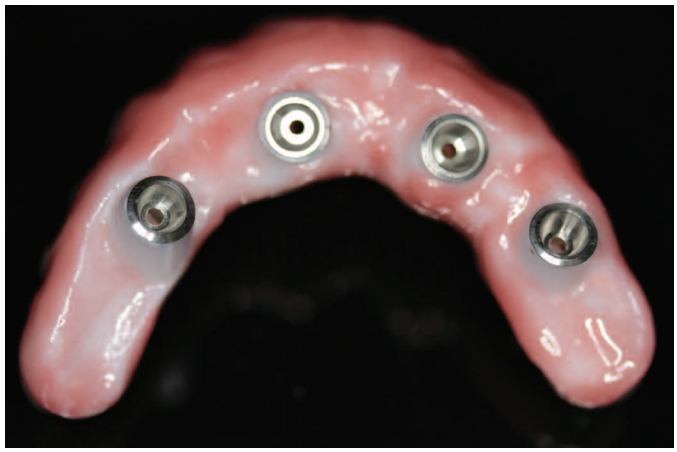


Fig. 23 Metal interfaces (CAL cylinders) cemented in place

Fig. 24 Final restoration with metal interfaces in place - side view

Fig. 25 Several shades of tissue colored porcelain was applied for this realistic appearance.

Option: The CAL® cylinders may be cemented into the finished restoration at chairside intra-orally if desired.

The definitive Monophase Prettau® zirconia restoration is then delivered to the restoring dentist. Figs. 26 - 28

Fig. 26 Definitive restoration palatal view – intraoral

Fig. 27 Maxillary zirconia bridge opposing acrylic mandibular hybrid

Fig. 28 Definitive restoration in place

As stated previously, the newly available translucent zirconia frequently eliminates the need for facial layering of porcelain for lighter shades. Following are examples of zirconia hybrid denture bridges with no facial layering. Figs. 29 - 32

Fig. 29 Application of final glaze

Fig. 30 Posteriors – no porcelain layering over the teeth

Fig. 31 Anterior view – no porcelain layering over teeth

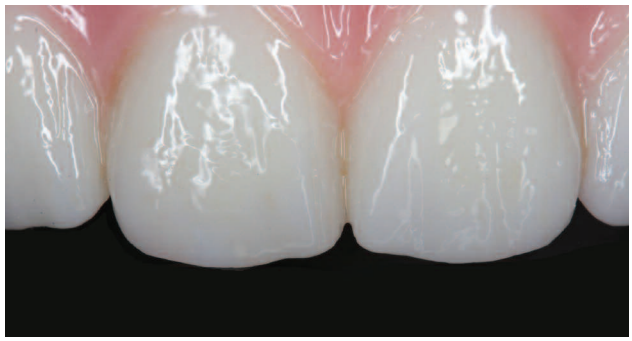


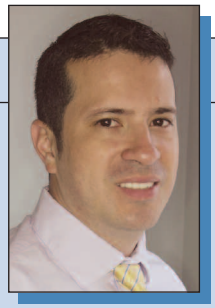
Fig. 32 Anterior close up - displaying esthetic translucency

Summary:

Screw-Retained hybrid bridges can now be fabricated with newly available translucent zirconia providing a superb natural appearance. The definitive restoration is Monophase zirconia in the functional load bearing areas rendering it resistant to occlusal abrasion, chipping and breakage.

Authors:
Michael Tischler DDS
Diplomate- International Congress Of Oral Implantologists
Faculty UMDNJ AAID Implant Maxi Course
José Echeverry CDT
Tischler Lab Director – Zirconia CAD/Cam Specialist
Darwin Bagley CDT
Senior Director of Technical Services for Attachments International


Michael Tischler DDS


José Echeverry CDT


Darwin Bagley CDT

Footnotes

[1]Long term success of 6 implants supporting a mandibular screw-retained fixed dental prosthesis: A clinical report, Ilser Turkyilmaz DDS, PhD, and John D. Jones DDS, J Prosthet Dent 2012;107:280-283

[2]Maintenance of Implant Hybrid Prostheses: Clinical and Laboratory Procedures Carl Drago, DDS, MS1 & Lynn Gurney, DDS2 Journal of Prosthodontics 00 (2012) 1–8 c_ 2012

[3]A Meta–analysis of Prosthodontic Complication Rates of Implant-supported Fixed Dental Prostheses in Edentulous Patients. Theodora Bozini DDS, et al. Int J Oral Maxillofac Implants 2011;26: 304-318

[4]Zirkonzahn ICE Translucent Zirconia value

Trademarks

CAL (California Abutment Luting) is a registered trademark of Attachments International, Las Vegas, NV

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