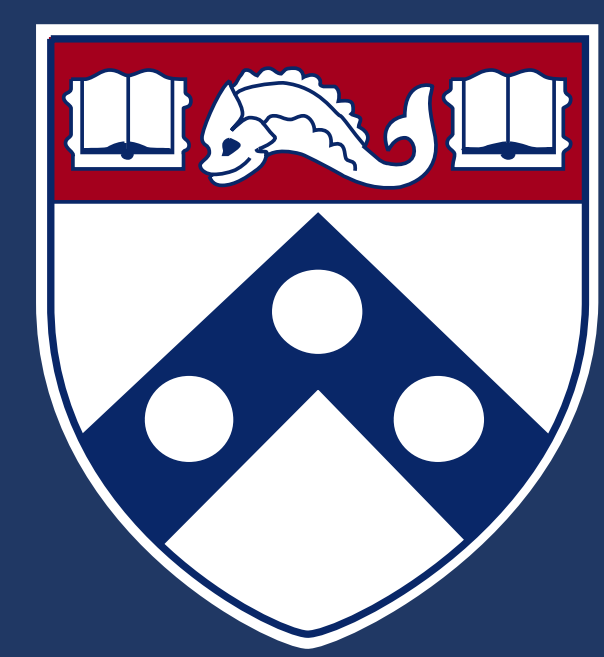




From Fracture to Functional: Reimagining Prosthetic Design Through Diagnostic Reversal in Complete Arch Fixed Implant-Supported Prostheses

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Introduction

The success of full-arch fixed implant-supported prostheses requires accurate diagnosis and treatment planning, verified occlusal vertical dimension (OVD), and sound prosthetic design. When these foundations are compromised, even strong materials like monolithic zirconia can fail. This case presents the concept of prosthodontic diagnostic reversal—where prosthetic failure reveals deeper diagnostic gaps and highlights the importance of restorative planning.

Case Report

A 49 year-old patient presented with fractured milled PMMA prototypes, supported by 8 maxillary and 5 mandibular implants. The prototypes, designed as FP1, had a deficiency of 7 mm from the ideal OVD, inadequate interocclusal restorative space, and lack of harmonious occlusion. Additionally, it was determined that the master cast obtained from a scan-body–based digital impression was inaccurate, with lack of passive fit. Through prosthodontic diagnostic reversal, OVD was reestablished using phonetics, esthetics, and functional methods and a repeatable centric relation record was made. A splinted, abutment-level open-tray impression produced an accurate master cast which was then verified. The prosthesis was redesigned from segmented implant level FP1 to a splinted MUA- level monolithic zirconia FP3 with cross-arch stabilization and passive fit.



Figure A: Initial presentation with fractured PMMA prototypes and a 7-mm deficiency in OVD; Figure B: Inaccurate full-arch digital impression using scan bodies with an incorrect MMR; Figure C: STL 's of the patient's OVD at intial PMMA prototype phase .

Discussion

Monolithic zirconia prostheses show high survival, but failures rise when OVD and restorative space are inadequate. For Zirconia Implant Supported Complete Dental Prosthesis 11–14 mm of interocclusal restorative space is recommended from the edentulous ridge to the opposing occlusal table [1]; in this case, OVD deficiency by 7 mm and limited interocclusal restorative space contributed to fracture of PMMA prototypes. Moreover, digital scan-body impressions can accumulate error over complete arches and jeopardize passive fit, whereas splinted conventional open-tray impressions remain more predictable [2], though novel scan-body designs, such as arcuate or extended forms, have shown improved precision comparable to conventional methods [3]. By applying diagnostic reversal, these issues were corrected and successfully tested in the new PMMA prototypes [5]. Redesigning from FP1 to FP3, with verified casts and functional records, restored harmony, stability, and passivity, supported by literature that stresses verification and prototype fabrication to ensure long-term success [1,4].

Results

The redesigned FP3 prosthesis restored OVD, occlusal harmony, and structural stability. Passive fit was verified, and the patient reported improved comfort, speech, and esthetics. Follow-up confirmed durability without complications.



Figure C: Diagnostic wax-up after a 7 mm increase in OVD

Figure D : Final implant-supported fixed complete dental prosthesis at increased OVD

Conclusion

This case demonstrates how prosthetic failure can reveal diagnostic shortcomings. Deficiencies in OVD, restorative space, and impression accuracy led to initial failure, but diagnostic reversal allowed for correction and successful rehabilitation. Long-term outcomes in full-arch zirconia prostheses depend not only on material strength but also on precise diagnostics, accurate impression techniques, and thoughtful prosthetic design.

References

