

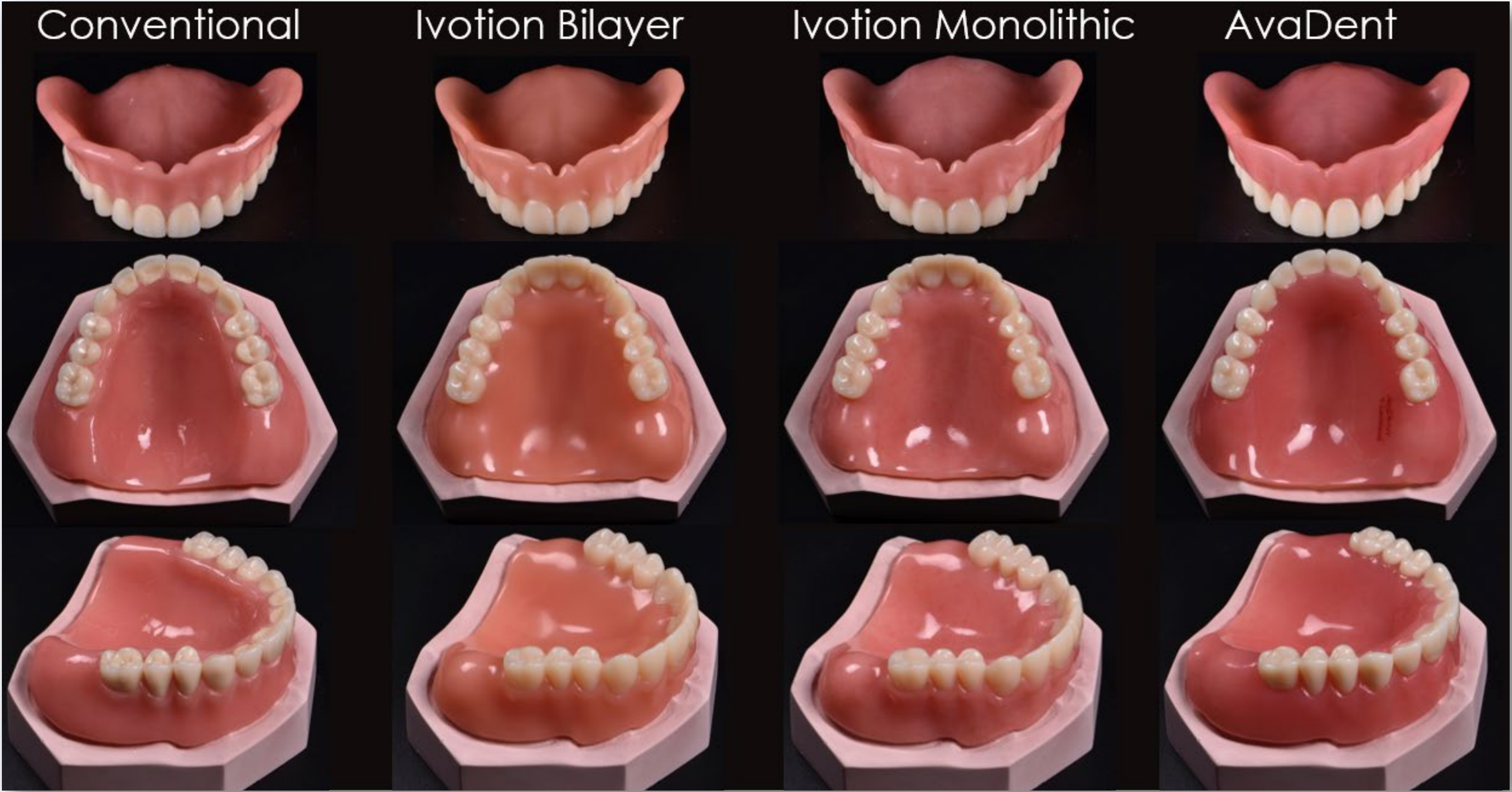
INTRODUCTION

Polymethyl Methacrylate (PMMA) has been widely used for complete dentures due to several favorable properties.¹ Those properties have been improved further through the development of pre-polymerized PMMA pucks, used in CAD/CAM dentistry to mill dentures.² A persistent weakness of dentures has been the bond between denture teeth and denture base. In recent years, manufacturers have developed monolithic PMMA pucks, which incorporate both tooth-colored resin and gingiva-colored resin within the same puck.³ The purpose of this study was to evaluate the fracture modes and ultimate failure strength of dentures fabricated from four different methods.



Four groups of dentures were fabricated, each with 20 samples:

- Conventional dentures (CD)
- Ivoclar Ivotion Base/Dent Digital Denture (IB)
- Ivoclar Ivotion Monolithic Digital Denture (IM)
- AvaDent XCL™ Monolithic Digital Denture (AD).

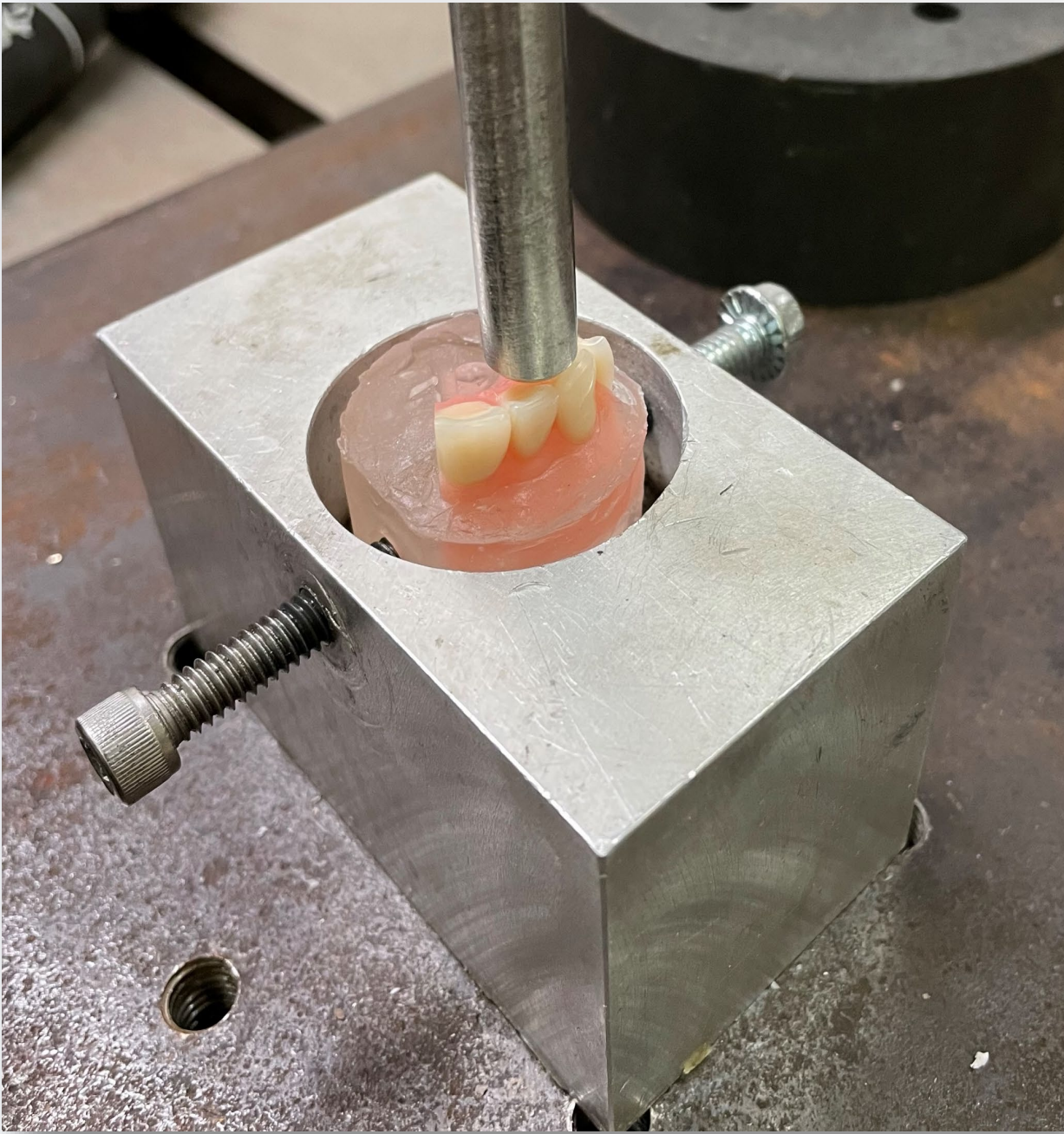


MATERIALS AND METHODS

A stone model of an edentulous maxillary arch was scanned before being used as a master cast to fabricate a conventional denture. It was subsequently printed and duped to fabricate 20 master casts.

The CD specimens were fabricated using Vivodent Plus DCL P5 teeth, packed with heat-cured PMMA. A matrix was fabricated to dupe the first specimen and maintain uniformity. The original master cast and first CD specimen were scanned and used to design and fabrication of the AD , IM, and IB groups.

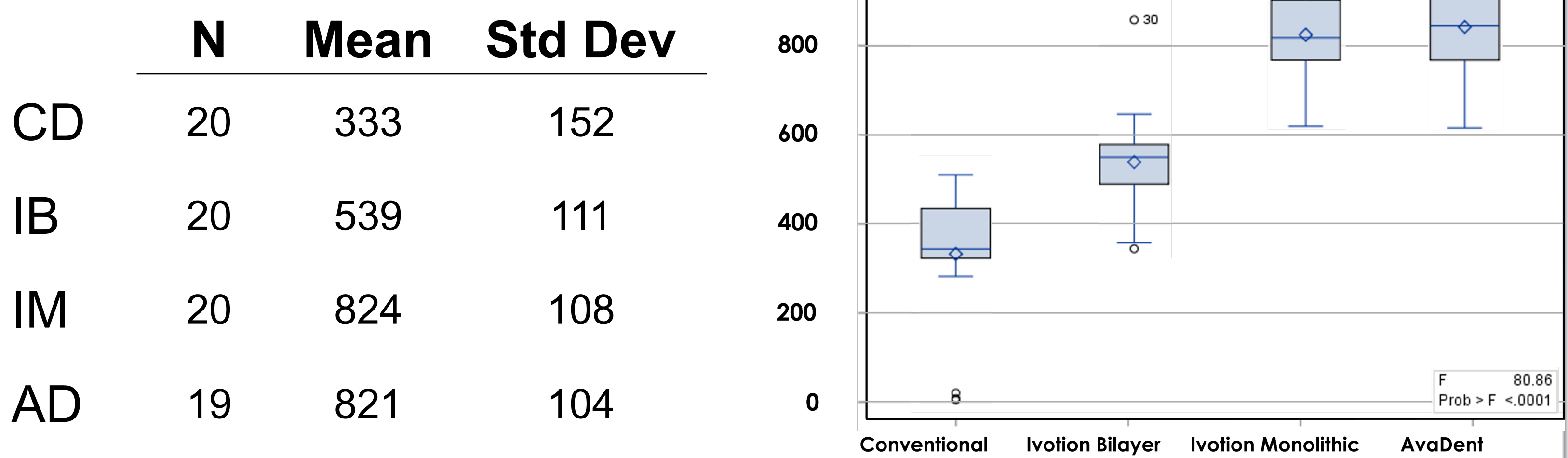
Once all dentures were fabricated, they were inspected for uniformity before being cut into the desired specimen shape. Then, each specimen was embedded in resin such that the long axis of the lateral incisor was tilted at 30 degrees labially. Once all specimens were embedded in resin, they were broken on an Instron unit. The maximum applied load was recorded. Upon failure, each sample was removed, photographed, and inspected for mode of failure.



RESULTS

The mean load to failure for monolithic denture specimens (AvaDent and Ivotion Monolithic) was significantly higher than that of conventional and bilayer denture groups. Frequency analysis of fracture modes showed that AvaDent and Ivotion Monolithic had significantly lower frequency of interfacial fracture compared to the other groups, suggesting the materials are truly monolithic.

Load at Failure (N)



The load to failure analysis indicated that the AD and IM groups demonstrated much higher measurements of load to failure compared to the IB and CD groups. These findings suggest dentures milled from monolithic PMMA have superior mechanical strength compared to the other groups

Fracture Mode

	 Cohesive	 Interfacial	 Mixed
Conventional	3 (15%)	11 (55%)	6 (33%)
Ivotion Bilayer	5 (25%)	12 (60%)	3 (15%)
Ivotion Monolithic	8 (40%)	1 (5%)	11 (55%)
AvaDent Monolithic	3 (16%)	0 (0%)	16 (84%)

The lack of interfacial fractures in the monolithic groups (AD and IM) suggests that these dentures maintain their integrity even under high loads, with failures occurring within the denture material rather than at the interface. This supports the manufacturers' claims of a monolithic material.

CONCLUSION

CAD/CAM dentures fabricated from monolithic materials demonstrate superior mechanical strength and absence of interfacial fractures, making them a promising option for edentulous patients. Further research with larger samples and long-term clinical evaluations is recommended to validate and expand on these findings.

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