



Can the Strength of 3D-Printed or Milled Implant-Supported Cantilevered Prostheses in New-Generation Resins be Comparable to Zirconia Depending on Their Height?

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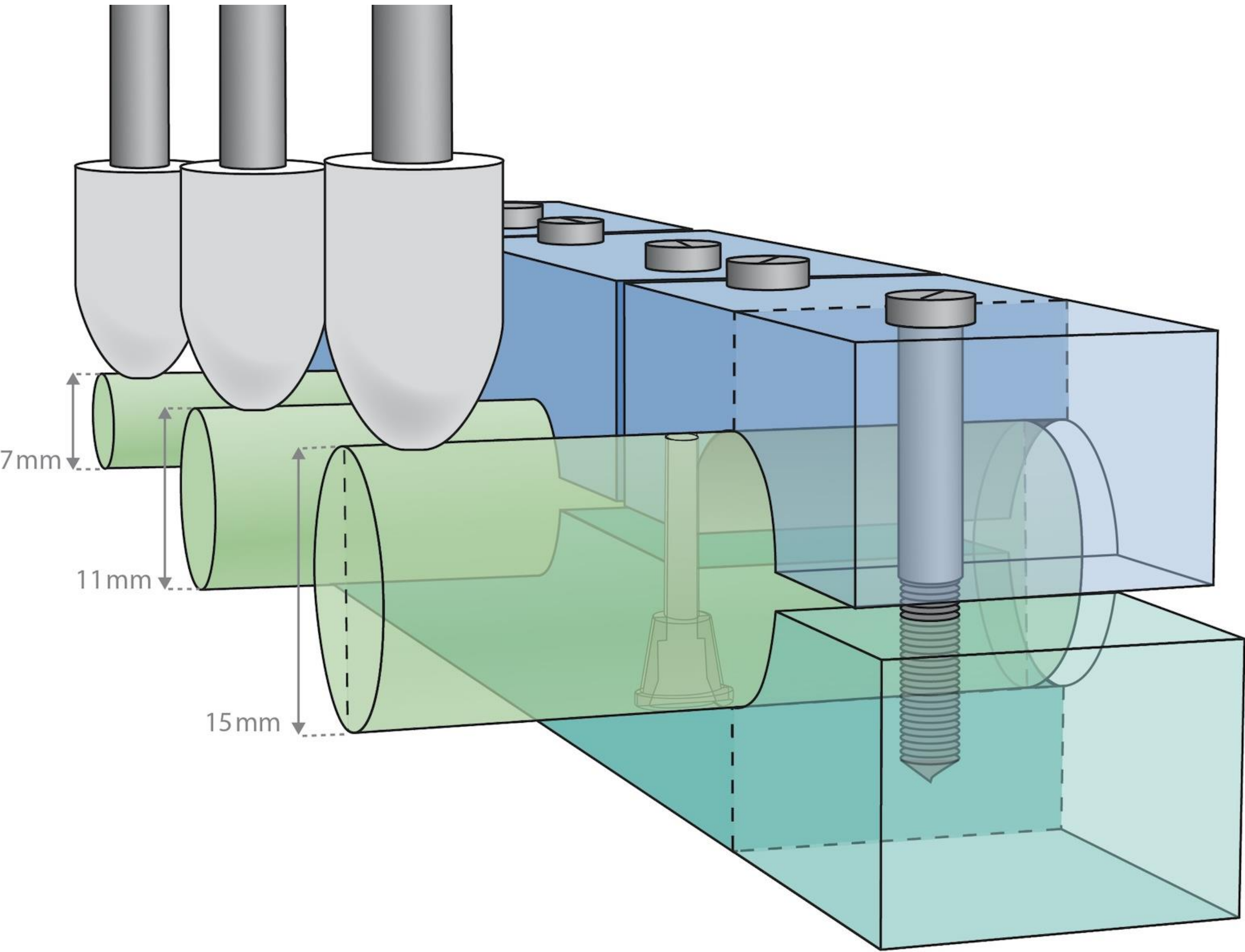


Introduction:

Monolithic implant-supported cantilevered complete-arch fixed prostheses (MISCAFPs) in new-generation resins intended for definitive use offer elasticity and reduced cost. However, how these new resins perform when interocclusal space, and accordingly, their height varies is not well-known. This study aimed to evaluate how framework height and cyclic loading affect the fracture strength of MISCAFPs 3D-printed (3DP) from resins for definitive use and milled (M) in high-impact polymer composite and zirconia, which was the control group.

Method:

Master standard tessellation language files (7, 11, 15×11×20-mm) including a titanium base (Ti-base) space that represented MISCAFPs were designed to fabricate specimens in 3DP resins for definitive use (a hybrid resin (3DP-FP) and a glass filler-reinforced resin composite (3DP-CT)), milled high-impact polymer composite (M-CR), and a strength gradient zirconia (M-ZR) (n=12). After fabrication, Ti-base abutments were cemented by using a dual polymerized resin cement and the specimens were divided into two groups: cyclic loading and control. The cyclic loading group was subjected to 1.2 million cycles of 50 N loading at 1.5 Hz. The load was applied to the distal extension of the specimens to simulate a cantilevered prosthesis. After cyclic loading, static load was applied in vertical direction at a crosshead speed of 1mm/min until failure occurred. Maximum load-to-failure values were recorded in Newtons.





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Results:

The interaction between material type and aging condition, material type, and framework height affected the fracture strength values ($P \leq .020$). One 3DP-CT and two 3DP-FP 7 mm-height specimens failed during cyclic loading. 3DP-CT led to the lowest and M-ZR led to the highest fracture strength, regardless of the aging condition and height ($P < .001$). The difference between 3DP-FP and M-CR specimens was nonsignificant ($P \geq .072$). The fracture strength values increased with framework height for all materials ($P \leq .001$).

Conclusion:

Considering previously reported clinical occlusal force values and measured raw data in the present study, 3DP-FP and M-CR may be alternatives to M-ZR when the interocclusal space is 11 mm or higher, while 3DP-CT may be suitable for patients without parafunctional habits when the interocclusal space is 15 mm or higher.

Clinical Implications

Implant-supported fixed prostheses with distal cantilevers can be fabricated may be more resistant to mechanical complications if the cantilever height is at least 11 mm for one of the tested AM resins (AM-FP) and 7 mm for strength gradient zirconia and high-impact polymer composite when the previously reported masticatory forces in the molar region are considered.

