



Received: January 17, 2026
Revised: February 11, 2026
Accepted: March 20, 2026

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Time-Dependent Changes in the Mechanical Properties of Directly Printed Tera Harz TC-85 DAC (Direct Aligner Clear) After Manufacturing

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Abstract

Objectives: To investigate the time-dependent changes in flexural strength, tensile strength, and surface hardness of Tera Harz TC-85 DAC (Direct Aligner Clear) aligners after manufacturing.

Methods: The aligner specimens were fabricated using a 3D printer and tested for flexural strength, tensile strength, and surface hardness on days 1, 7, 14, 21, 30, and 60 after production. The flexural strength and tensile strength were tested by a universal testing machine, while the surface hardness was measured using a Shore type D durometer for the specimen surface hardness. Data were recorded and analyzed to determine changes in these mechanical properties for 60 days of room-temperature storage after manufacturing.

Results: Changes in the mechanical properties were observed over time. Compared to day 1, the mean tensile strength significantly decreased from day 7 to day 60 ($p < 0.05$), while the mean flexural strength significantly decreased from day 7 to day 30 ($p < 0.05$) with a significant increase in the mean flexural strength on day 60, compared to day 30 ($p < 0.05$). The mean surface hardness also significantly declined on day 21 ($p < 0.05$) with a gradual rise until day 60.

Conclusions: In general, the three mechanical properties of directly printed clear aligners decreased 7 days after manufacturing. However, these mechanical properties remained stable until day 60. Further studies are required to evaluate long-term stability of the aligners under various clinical conditions.

Keywords: 3D printing, clear aligner, flexural strength, tensile strength, surface hardness