

Objective

To evaluate the flexural strength (FS), flexural modulus (FM), and fatigue limit (FL) of 3D-printed denture teeth (DT) and temporary crown and bridge (T-C&B) resins.

Materials and Methods

60 rectangular 3D models (25x2x2 mm, ISO 4049) were designed (MeshMixer, Autodesk) and 3D-printed (Form 2, Formlabs) at 45 degrees angle with the build platform at a z-axis resolution of 50 microns with two dental resins: DT and T-C&B (Formlabs). All specimens were post-processed following the manufacturer's recommendation for each resin. The specimens from each resin were subdivided into two groups (n:30). The specimens of group A were loaded in a three-point bending test appliance (span=20 mm) using a Universal Testing Machine (Instron ElectroPuls 3000) at a crosshead speed of 1 mm/min and the FS and flexural FM were calculated. The specimens of group B were tested for FL using the staircase approach starting at 60% FS maximum up to 1.2M cycles at 20Hz. The data were analyzed using the one-way ANOVA and Weibull distribution ($\alpha = 0.05$).

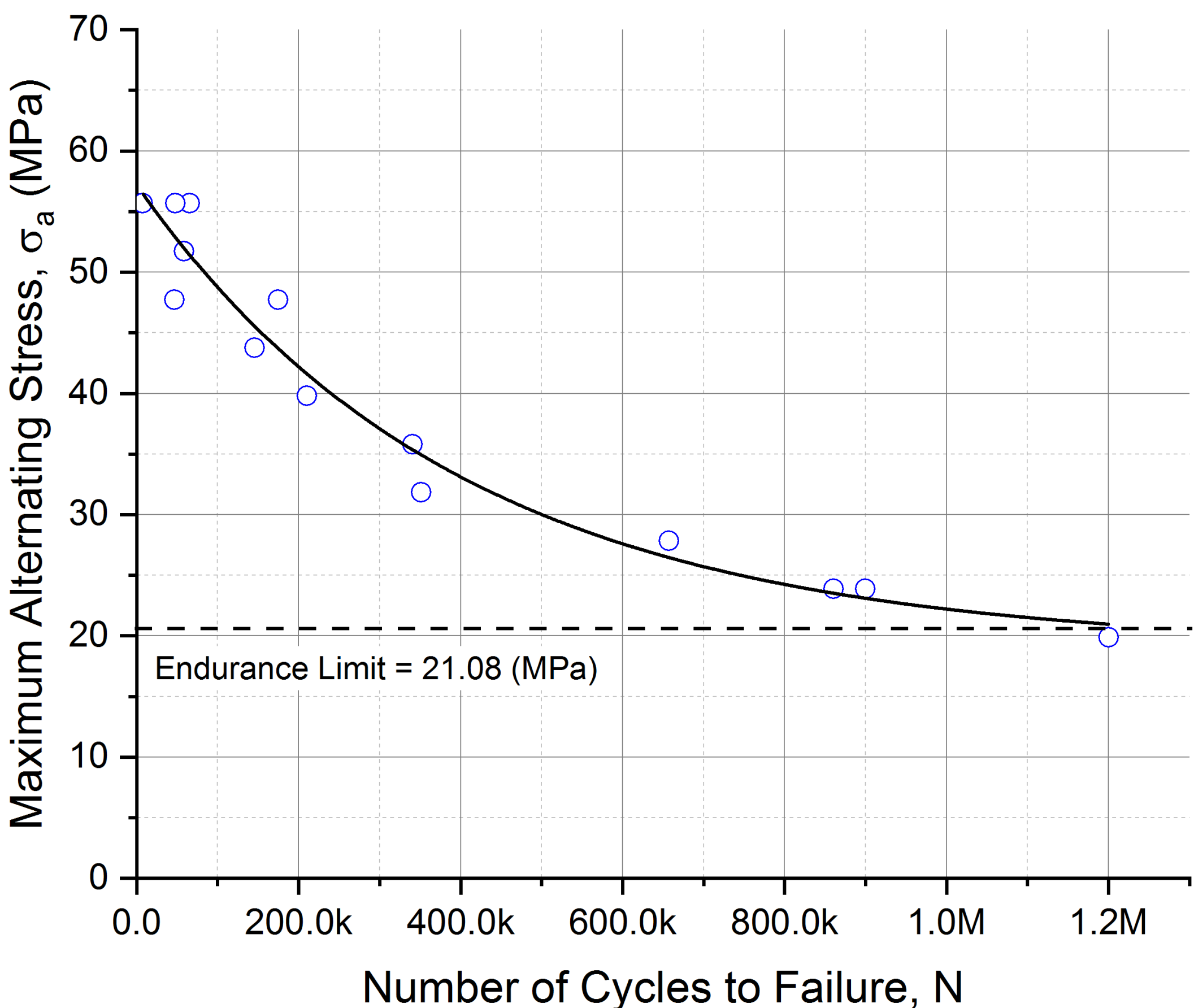


Figure 1. Fatigue Survival using S-N (Wöhler) Diagram of the Temporary Crown and Bridge (T-C&B).

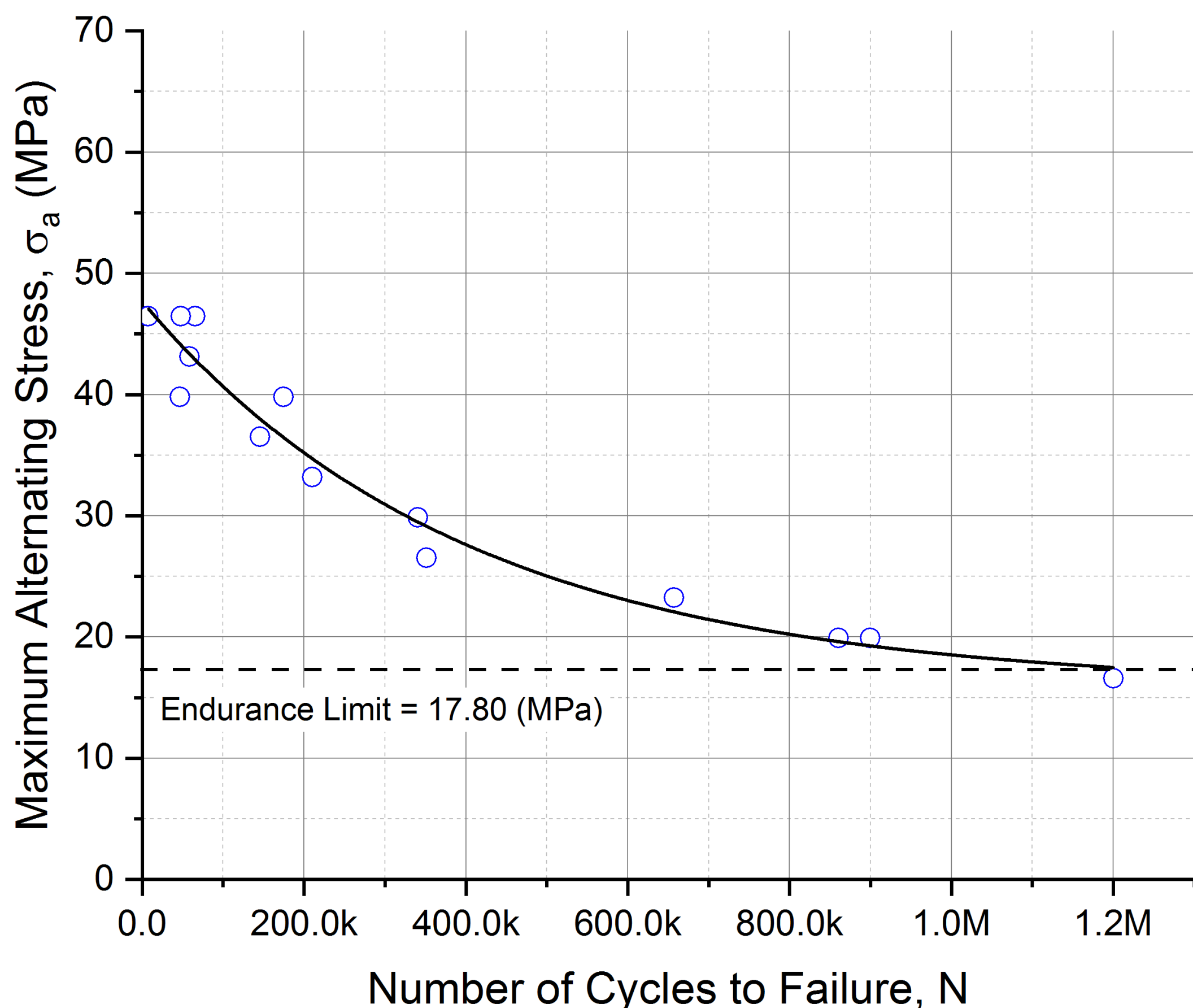


Figure 2. Fatigue Survival using S-N (Wöhler) Diagram of the Denture Teeth (DT).

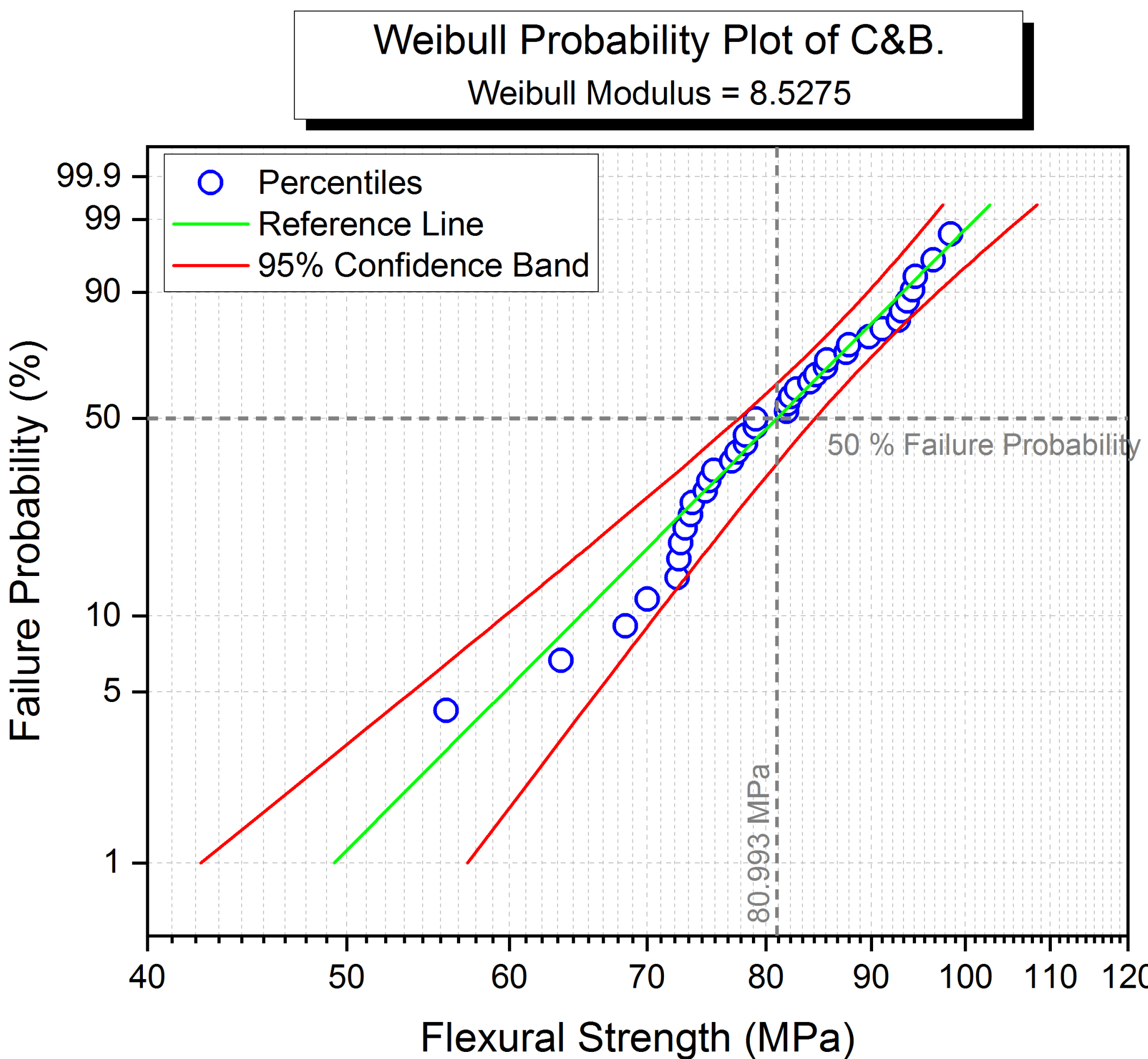


Figure 3. Weibull Analysis of the Temporary Crown and Bridge (T-C&B).

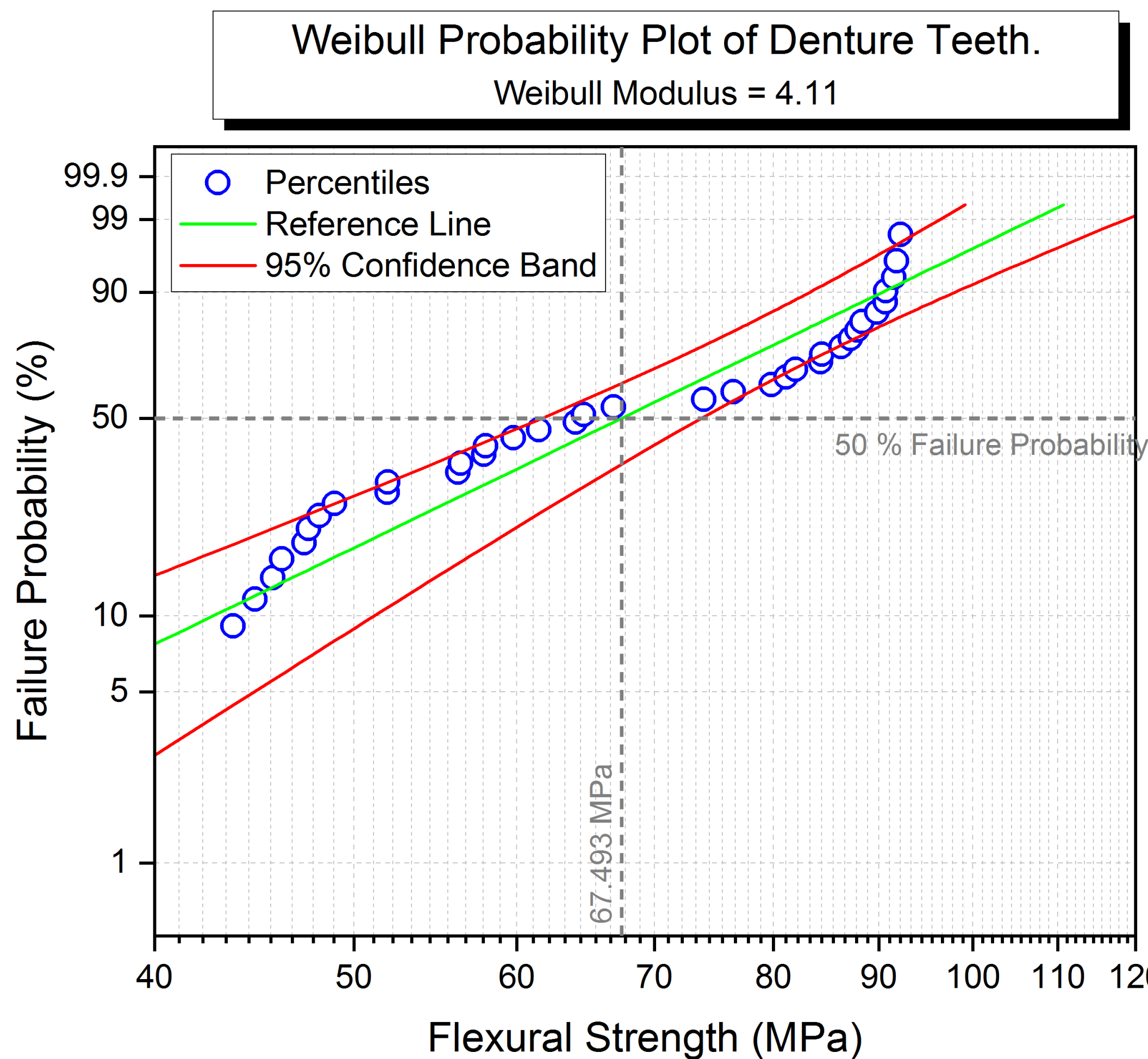


Figure 4. Weibull Analysis of the Denture Teeth (DT).

Results

The results showed that the T-C&B had significant higher FM (2.7 ± 0.4 GPa) than DT (1.8 ± 0.1 GPa) and higher FS (79.6 ± 12.1 MPa) than the DT (66.4 ± 18.5 MPa). Weibull analysis showed that T-C&B has a more uniform narrower spatial distribution of defects (m : 8.53) than DT (m : 4.11). The FL was 21.08 MPa for T-C&B and 17.80 MPa for DT.

Table 1. Flexural Strength and Modulus of the 3D printed resins used in this study.

	Flexural Strength	Flexural Modulus
C&B	79.6 ± 12.1^A	2.7 ± 0.4^A
Denture Teeth	66.4 ± 18.5^B	1.8 ± 0.1^B

*Uppercase letters show differences between groups.

Conclusion

3D-printed T-C&B resin presented better mechanical properties than DT resin with higher FS, FM, and FL.

Acknowledgement

This study was supported by the University of Florida College of Dentistry, Center for Dental Biomaterials.