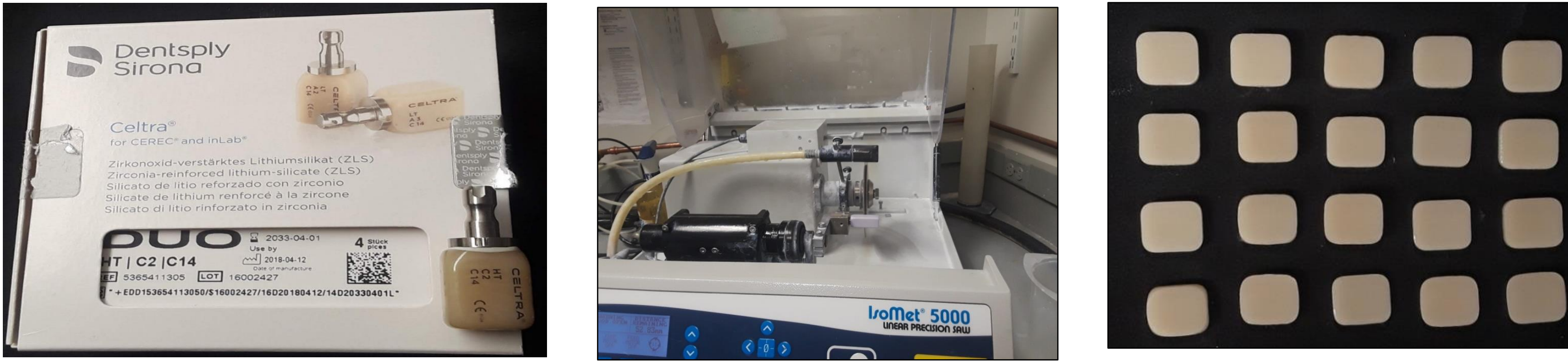


Objectives

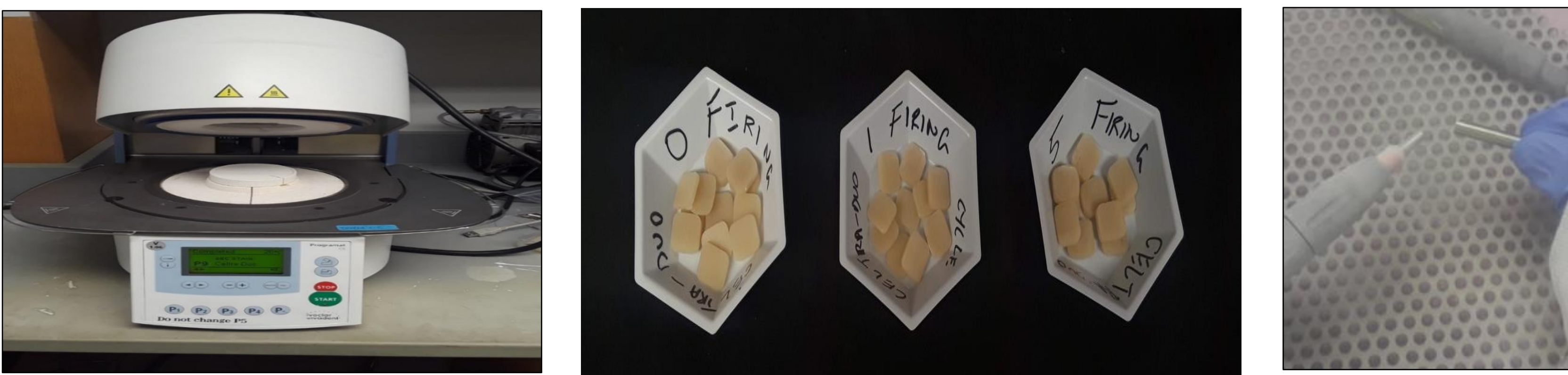
To evaluate the effect of different firing cycles and etching condition on resin cement tensile bond strength of zirconia reinforced lithium disilicate system glass ceramics to titanium.

Materials & Methods

Zirconia reinforced lithium disilicate CeltraDUO (ZLS) were sectioned into 53 rectangular tiles (2 mm thickness, 12.5mm width and 14mm length) using Isomet 5000 linear precision saw with a diamond blade.



The tiles were heat treated randomly as per the DOE with 0, 1 or 5 firing cycles in Programat CS furnace (Ivoclar Vivadent). The initial firing was crystallization cycle at 820°C for 1 minute. From the second firing cycle onward it was subjected to 770°C for 1 minute.



The tiles were then subjected to different etching time and etchant concentration as per the randomized DOE design. Two different ceramic etchant concentrations of 5% (Ivoclar Vivadent) and 9.6% (Pulpdent) hydrofluoric acid were used. Three etching times of 20, 50, and 80 seconds were used depending on the DOE.

The tiles were thoroughly rinsed with sprayed water for 10 seconds and dried after etching.



Titanium pins (4.8mm in diameter, 1 inch in length) were prepared for cementing on the tiles. The titanium pins were sandblasted on the flat base end. Self-adhesive resin cement TheraCem was used for cementing the flat end of titanium pins onto the etched lithium disilicate tiles. A vertical load of 10N was placed for 40 minutes on each pin. A tensile test (TBS) was performed using a universal mechanical testing machine, Instron. Failure loads were recorded.



Results

The values of tensile bonding strength were calculated and analyzed via one-way ANOVA and linear regression model using SAS JMP14.

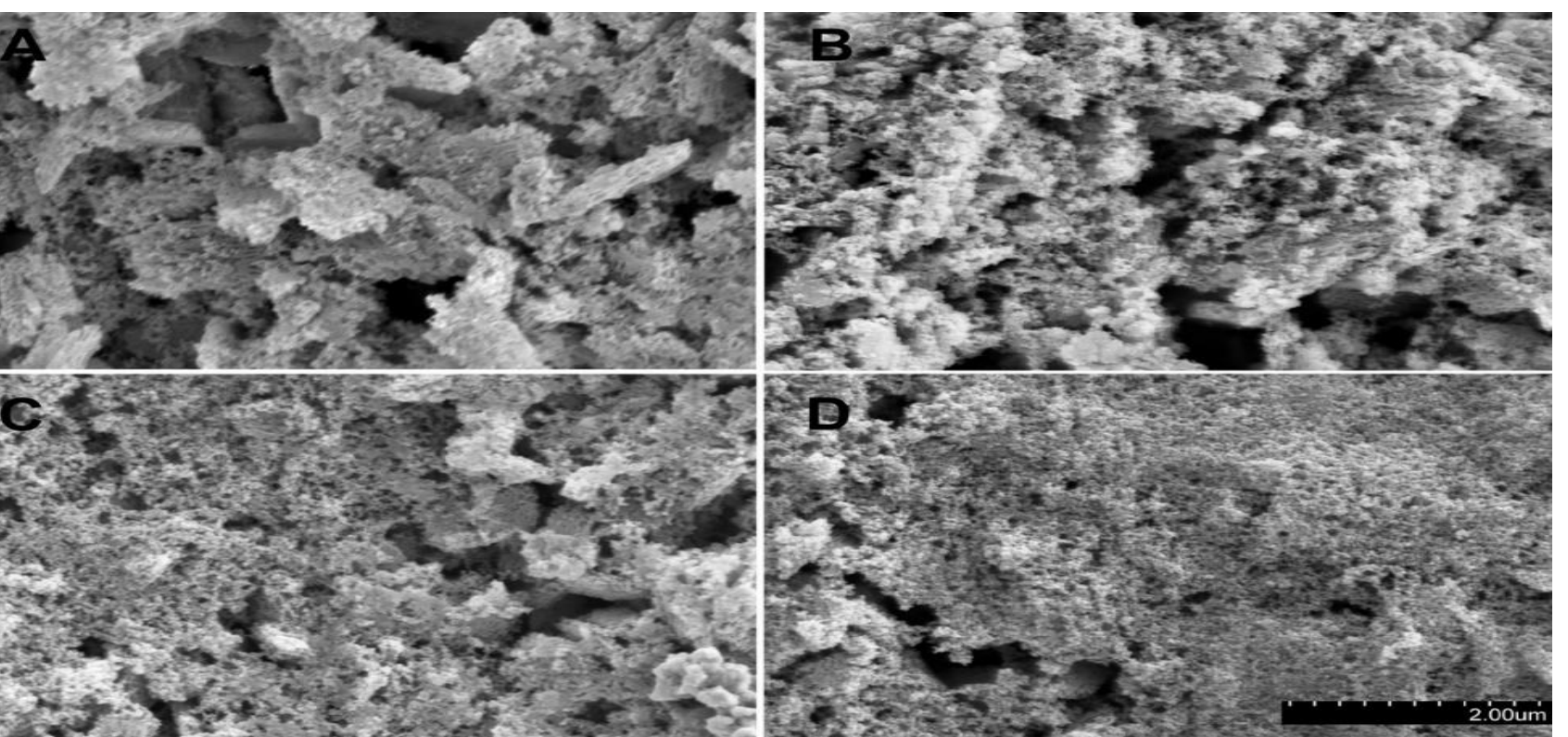


Figure 1. SEM images after 1 firing cycle, 5%HF etching for A)10 s, B)20 s, C)30 s, and D) 40 s

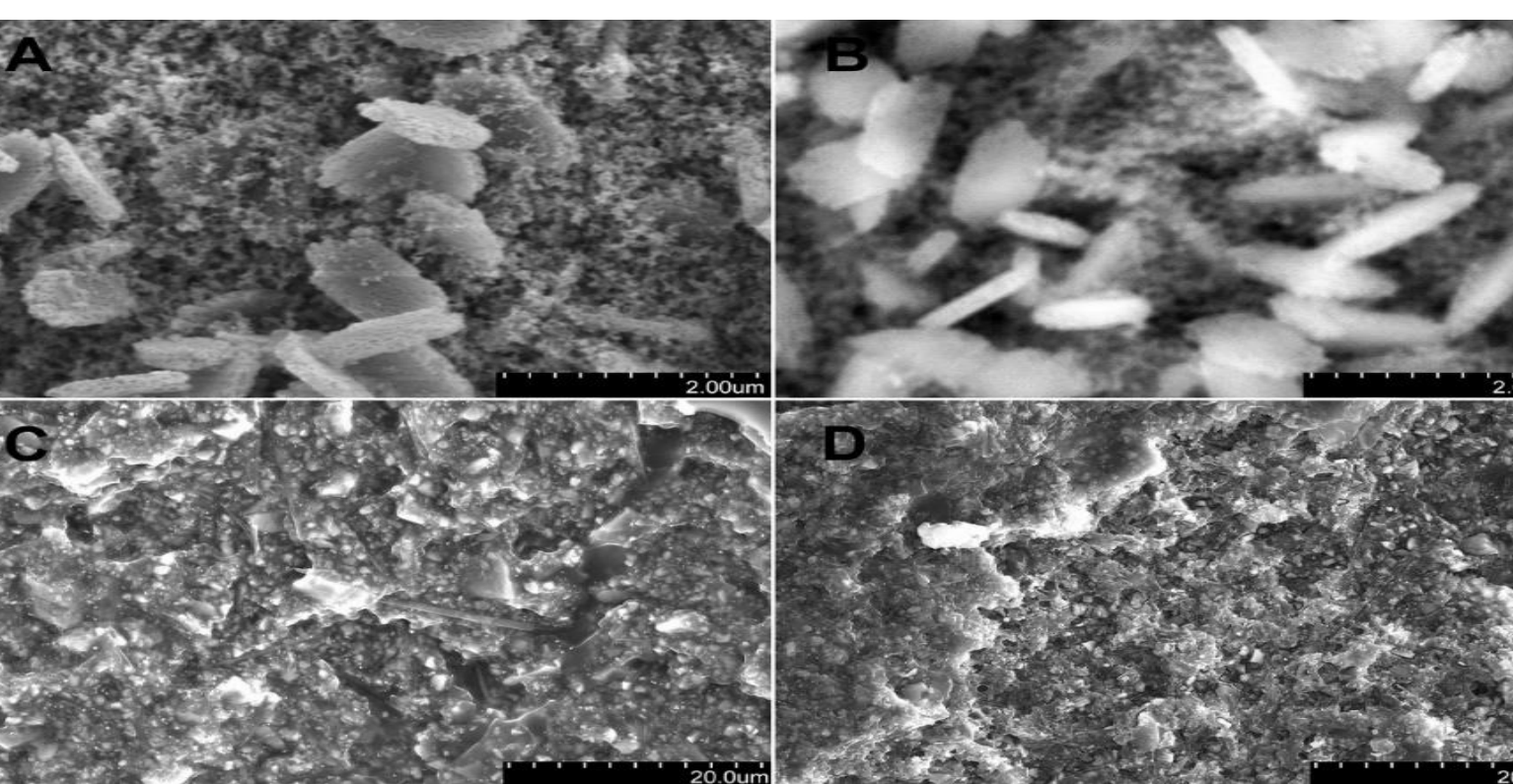


Figure 2. SEM images after 1 firing cycle, etched by 5%HF for A) 60 s and B) 300 s. and debonded (C) 10 s, and D) 30 s.

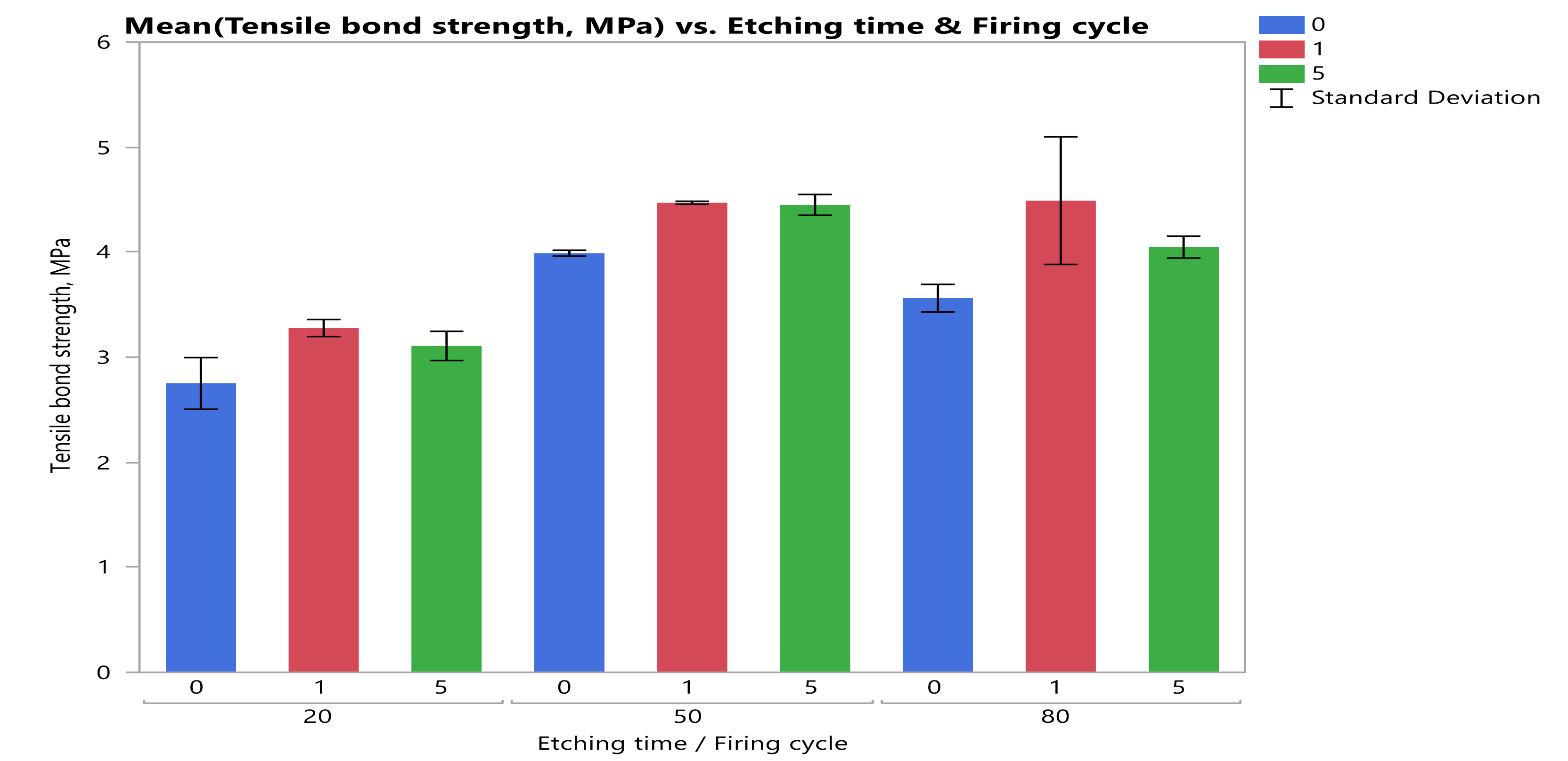


Figure 3. TBS values when subjected to 20, 50 and 80 sec of etching time; 0, 1 and 5 firing cycles

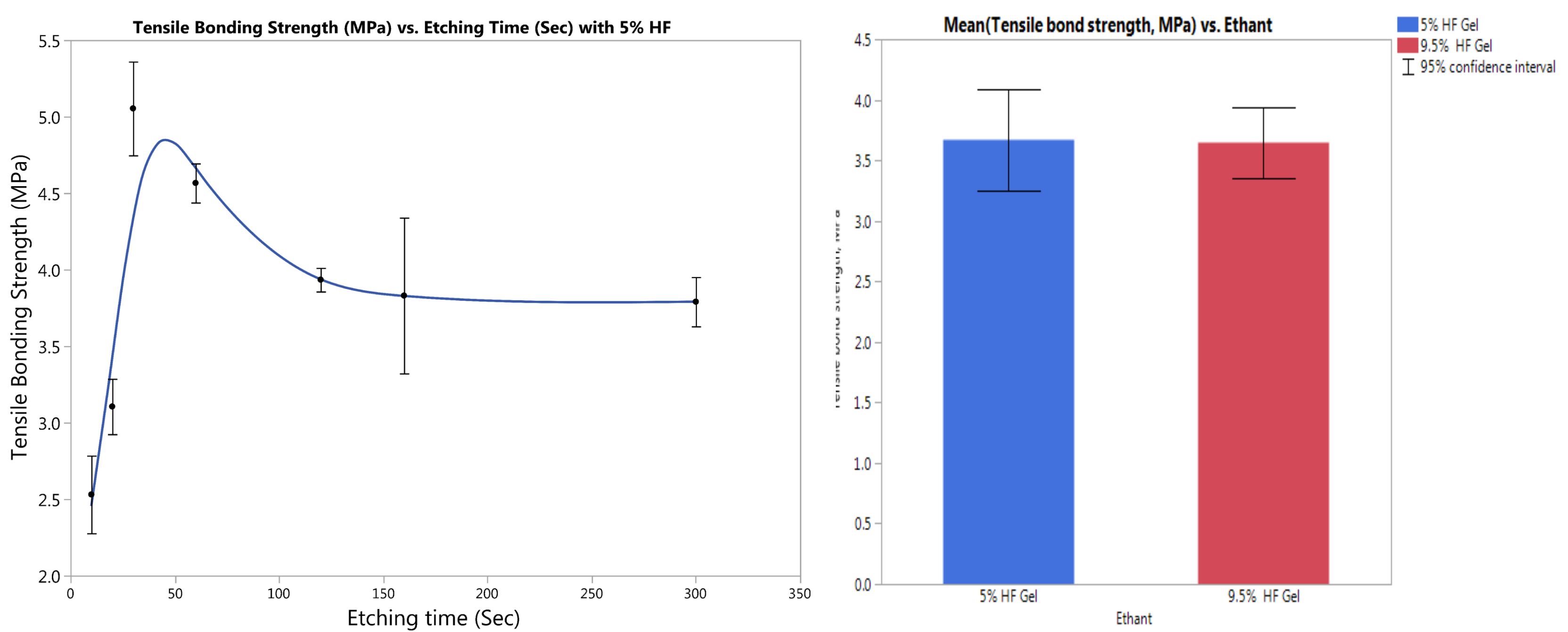


Figure 4. Bivariate plot of TBS and etching time of CeltraDUO after one firing cycle and 5% HF etching.

Figure 5. Tensile bonding strength when subjected to 5 and 9.5% HF etchant concentration.

Conclusion

- Etching time and firing cycle directly affect the TBS. The highest load to failure was observed at 30-60 sec of etching and the least load to failure was observed at 20 sec of etching.
- In terms of firing cycles, 1 firing cycle provided the highest load to failure in contrast to least load to failure observed as-machined without firing.