

Effects of acid hydrolysis and mechanical polishing on surface residual stresses of low-fusing dental ceramics.

STATEMENT OF PROBLEM: Cracks may arise in a ceramic restorative material over time, resulting in sudden fractures at stresses well below the yield stress. **PURPOSE:** This study evaluated by means of indentation technique the effects of acid hydrolysis and mechanical polishing on the surface residual stresses of low-fusing ceramic materials. **MATERIAL AND METHODS:** A total of 64 ceramic bars were formed to produce 4 groups of 16 bars each for 4 ceramic materials (Duceram-LFC Dentin, Duceram-LFC Enamel, Finesse Dentin, and Finesse Enamel). Four surface-treatment groups (n=4) were then formed for each of the 4 materials. The 4 surface treatments were control (autoglaze), hydrolysis, glaze/polish, and polish/glaze. A Vickers indenter contacted the Duceram-LFC specimens with a 5-N load and the Finesse specimens with a 3-N load for 10 seconds. Scanning electron microscope (SEM) was used to study surface texture before and after hydrolysis and polishing. Differences in mean crack lengths were analyzed with 1-way analysis of variance and least significant difference test ($\alpha=.05$.) **RESULTS:** SEM showed obvious surface flaws as a result of hydrolysis on Duceram-LFC Enamel and Dentin specimens. However, statistical analysis of the resulting crack lengths revealed no significant differences between values for the control groups (58.16 +/- 3.88) (53.53 +/- 2.67) and hydrolysis groups (57.11 +/- 4.09) (54.54 +/- 3.15) for Enamel (P=.081) and Dentin (P=.093) respectively. When comparing polished groups and nonpolished groups, the mean crack lengths were significantly shorter for polished specimens of Duceram-LFC Enamel (53.76 +/- 3.17), Finesse Enamel (40.56 +/- 3.31), and Finesse Dentin (39.76 +/- 3.81) porcelains compared with their control groups (58.16 +/- 3.88) (43.54 +/- 4.12) (41.19 +/- 3.47), respectively (P<.0001). The mean crack lengths were significantly longer for polished specimens of Duceram-LFC Dentin (59.16 +/- 3.52) porcelain compared with the control group (53.53 +/- 2.67) (P<.0001). **CONCLUSION:** Within the limitations of this study, hydrolysis did not improve surface residual stresses of Duceram-LFC and Finesse ceramic materials. Mechanical polishing improved surface residual stresses of all materials tested, except Duceram-LFC Dentin porcelain.