CLINICAL AND MECHANICAL EVALUATION OF A NEW ALL-CERAMIC RESTORATIVE MATERIAL TURKOM-CERA™

BANDAR MOHAMMED ABDULLAH AL-MAKRAMANI
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Abstract

The mechanical properties and clinical performance of Turkom-Cera system were evaluated in this study. The mechanical properties evaluated were; flexural strength, microhardness, shear bond strength, fracture resistance and marginal integrity.

The biaxial flexural strength and hardness of Turkom-Cera compared to two other all-ceramic systems (In-Ceram and Vitadur-N) were investigated. The Turkom-Cera exhibited significantly higher flexural strength (506.8 MPa) than In-Ceram (347.4 MPa) and Vitadur-N (128.7 MPa) ceramic materials. However, In-Ceram core has significantly higher hardness (1116.2 VHN) than Turkom-Cera (1002.1 VHN) and Vitadur-N (812.8 VHN) all-ceramic materials.

In order to find the optimal choice of luting cement and surface treatment for Turkom-Cera all-ceramic material, the shear bond strength of four different luting cements (zinc phosphate, glass ionomer, resin modified glass ionomer and resin cement) to the Turkom-Cera all-ceramic discs was evaluated. In addition, the effect of surface treatments (no treatment as control, sandblasting, silane application and combinations of these treatments) on the shear bond strength of resin cement to Turkom-Cera was also investigated. The shear bond strength increased significantly from zinc phosphate (0.92 MPa), glass ionomer (2.04MPa), resin modified glass ionoer (4.37 MPa) to resin cement (16.42 MPa). Sandblasting followed by silanization of the Turkom-Cera specimens provided the highest bond strength value (19.13 MPa). The control group exhibited significantly lower shear bond strength (10.83 MPa) than the other three groups. However, there were no significant differences in the shear bond strength of the sandblasting (16.42 MPa), silane (16.18 MPa) and sandblasting + silane (19.13 MPa) groups.

The occlusal fracture resistance of Turkom-Cera all-ceramic copings compared to Procera AllCeram and In-Ceram all-ceramic copings was evaluated using metal dies and natural teeth as a supporting structure. In both cases, using metal dies or natural teeth as a supporting structure, the mean load at fracture of Turkom-Cera (2184 N / 1341.9 N) was significantly more than Procera (1953.5 N / 975.0 N) ($P<0.05$). There were no significant differences in the mean loads at fracture between In-Ceram (2041.7 N / 1151.6 N) and Procera and also between Turkom-Cera and In-Ceram ($P>0.05$).

The effect of zinc phosphate, glass ionomer and resin cements on the occlusal fracture strength of Turkom-Cera all-ceramic copings were also assessed. The mean load at fracture of Turkom-Cera copings cemented with zinc phosphate, glass ionomer and resin cements were 1537.4 N, 1294.4 N, and 2183.6 N, respectively. There was a significant difference in the mean load at fracture between the three luting cements used ($P<0.05$). The effect of marginal design (chamfer or shoulder) and artificial ageing (30-day water storage and 500 thermocycles) on the occlusal fracture resistance of Turkom-Cera copings were also investigated. There was no influence of the finish line design and artificial ageing used in this study on the occlusal fracture resistance of Turkom-Cera all-ceramic copings ($P<0.05$).

The marginal adaptation of Turkom-Cera copings compared to In-Ceram and Procera copings was assessed. The mean marginal discrepancy for Turkom-Cera, In-Ceram and Procera were 49.2 µm, 71.5 µm and 34.4 µm, respectively. It was verified that there was a statistically significant difference among the marginal discrepancy of the three all-ceramic systems ($p<0.05$). In this study, there were no significant differences in the mean marginal discrepancy of Turkom-Cera crowns between the chamfer (49.2 µm) and shoulder (44.0 µm) groups ($p>0.05$).

A preliminary prospective study to evaluate the clinical performance of Turkom-Cera crowns was conducted. This study was carried out to complement the different mechanical tests that have been done on the Turkom-Cera all-ceramic material. In this study, 20 Turkom-Cera crowns were evaluated for a mean evaluation period of 21.5 months. During the whole observation period, 1 of the 20 Turkom-Cera crowns was found to have fractured after a service time of 14 months. The veneering porcelain chipped in 3 molar crowns, but did not compromise the integrity of the crowns. The other parameters were rated satisfactory according to the Modified United States Public Health Service (USPHS) criteria. All patients expressed satisfaction with their restorations and did not report any sensitivity during or after treatment.

Declaration

I certify that this thesis is based on my independent work, except where acknowledged in the text or by reference. No part of this work has been submitted for a degree or diploma to this or any other university.

Dr. Bandar Mohammed Abdullah AL-Makramani
Date:

Supervisor: **Prof. Dato' Dr. Abdul Aziz bin Abdul Razak**
Head
Biomaterial and Dental Technology Unit
Faculty of Dentistry,
University of Malaya,
Kuala Lumpur,
Malaysia.

Co-Supervisor: **Prof. Dr. Mohamed Ibrahim Abu-Hassan**
Dean
Faculty of Dentistry,
Universiti Teknologi MARA,
Selangor,
Malaysia.

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