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ENHANCED MECHANICAL PROPERTIES, TRANSLUCENCY AND AGING RESISTANCE OF YTTRIA-STABILISED ZIRCONIA FOR RESTORATIVE DENTISTRY

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SUMMARY

Zirconia restoration in dentistry poses various challenges in its application. These challenges include high opacity that reduces likenesses such as those of natural teeth, and aging in a humid environment. Thus, our research aimed to develop zirconia nanomaterials that can resolve the problems currently encountered by zirconia restorations. Nanosized 3 mol% yttria-stabilized zirconia was used throughout this study. Colloidal processes have been employed to overcome agglomeration problems that occasionally occur at the nanosized level. Optimum pH adjustment of pH 2, adequate dispersant amount of 0.5 wt% polyethyleneimine and appropriate powders dispersion technique which involved combination of ultrasonic and ball milling has improved the colloidal stability of zirconia suspension. Extended investigations have confirmed that zirconia with good translucency, low porosity, and high mechanical properties was produced by using the combined colloidal processes of slip casting and cold isostatic pressing (CIP) followed by sintering between 1500 °C–1600 °C. Further evaluation revealed that the mechanical and translucent properties of the fabricated material were improved compared to those of commercially available materials. The susceptibility of zirconia to aging or low-temperature degradation due to rapid moisture-assisted transformation over time under aqueous oral environment has also been tested. The results indicated that the newly developed zirconia maintains high fracture toughness and flexural strength when subjected to an oral environment that simulates a duration of 15–20 years and comparable to commercially available zirconia. These results suggest that the colloidal–CIP zirconia holds significant potential to be used in restorative dentistry.

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