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University of Bari
Department of Odontostomatology and Surgery
C.L.S.O.P.D.. Dept. Head: Prof. D. Devito

ZIRCONIA: MECHANICAL PROPERTIES

F. Inchingolo, A. Palladino, G. Dipalma, A. Inchingolo, M. Marrelli, A. Inchingolo, M. De Carolis, M. Serafini, V. Angelini, S. Di Teodoro

AIMS: 1) To analyze how surface roughness and staining affect the mechanical strength of zirconia-based ceramic materials, which are used in combination with CAD/CAM technologies. **2)** To compare the type of failure of eight commercially available ceramics for aesthetic coating of zirconia structures; **3)** To evaluate hardness variation of zirconia and ceramics after 120 days in a simulated physiological environment.

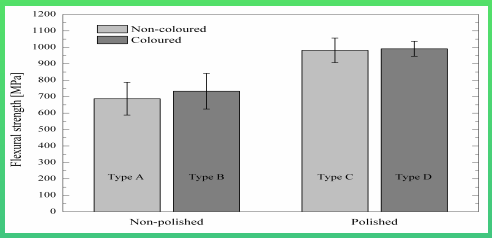
MATERIALS AND METHODS: The mechanical strength of a commercially available zirconia-based ceramic material (Bio ZS Blank, Kavo Everest®) was evaluated using a three-point bending test (ISO 6872). Besides, the mechanical properties of eights types of "aesthetic coating" ceramics were analyzed by three-point bending test of bi-material zirconia/coating samples and by Vickers microhardness measurements. These measurements were repeated after maintaining the materials under simulated physiological conditions, such as artificial saliva (Oralbalance®, Laclade) at 37° C, in order to evaluate the evolution of surface hardness after implantation into the oral cavity.

TYPE OF SAMPLE	DESCRIPTION
TYPE A	SINTERED
TYPE B	SINTERED AND STAINED
TYPE C	SINTERED AND POLISHED
TYPE D	SINTERED, STAINED AND POLISHED

RESULTS AND CONCLUSIONS:

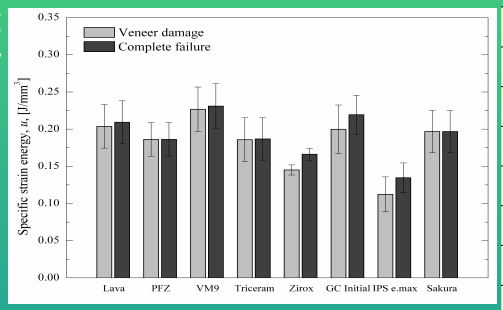
1) Surface roughness of zirconia samples had significant effects on their mechanical strength, while the staining procedure did not produce significant variations in strength.

TYPE OF SAMPLE	Surface roughness	Flexural strength		Weibull modulus	
		Mean	SD	Modulus	Characteristic strength
TYPE A	1.75 ±0.47	687.50	99.89	7.89	728.58
TYPE B	1.27±0.36	733.09	108.55	7.33	779.31
TYPE C	0.13±0.03	981.68	74.72	14.80	1004.85
TYPE D	0.12±0.03	991.04	45.71	21.71	1006.91

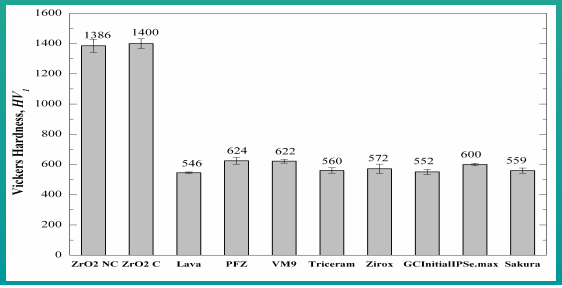


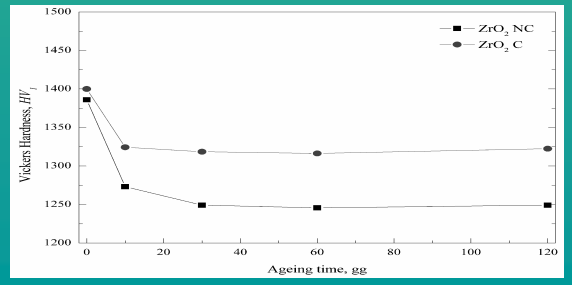
2) The mechanical testing of bi-material samples (zirconia/coating) showed different types of failure among the selected ceramics. They were mainly caused by different levels of adhesion between zirconia and coating ceramics. Vita VM9® ceramics exhibited the best mechanical performance.

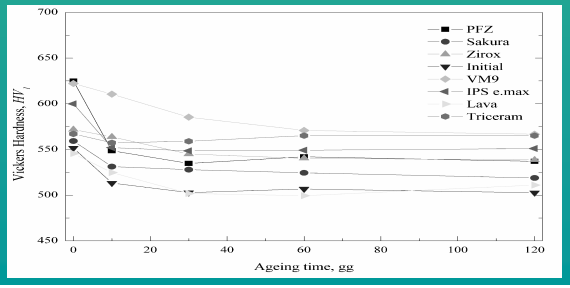
3) A general hardness decrease was noticed after the first 30-day exposure to the simulated physiological environment, even though variations were within 10%. No significant variations were noticed 30 and 120 days after exposure, except for Triceram® which did not show significant variations after exposure.



TYPE OF CERAMIC	FAILURE MECHANISMS
Lava Ceram®	S, M
Ceramco PFZ®	S
Vita VM9®	S, M
Triceram®	S, M
Zirox®	M, A
GC Initial ZR®	S, M
IPS e.max®	A
Sakura Interaction®	S







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