THE REVIEW

Amber® Mill

VER.01

English

Human-Aid
System Supplier
HASS

01

Date (version No.) : 2021.03.12(Ver.01)
Product : Amber Mill

Type : In-house

Machinability and Edge Stability of Amber Mill

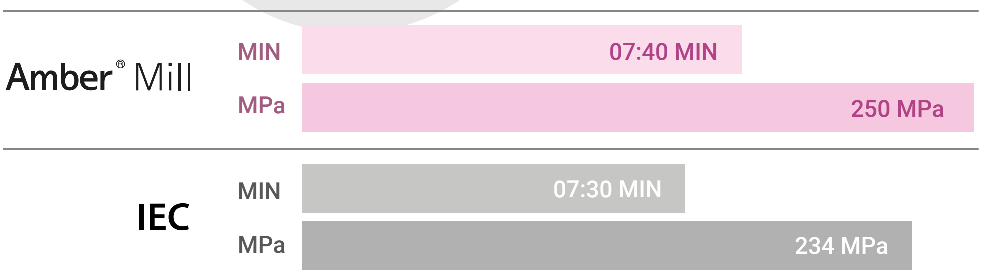
In this study, Machinability and Edge stability of Lithium disilicate Block were evaluated. The group was compared and analyzed with Amber Mill and IEC.

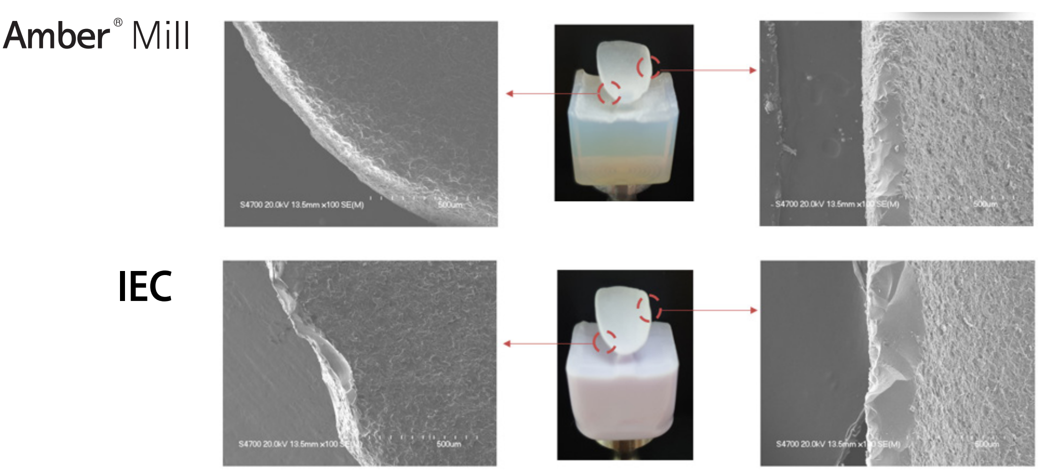
Materials and Method Information

The milling equipment was inLab MCXL(Sirona Dental Systems GmbH, Germany).
And the milling equipment was set in standard mode of IPS e.max CAD program, and the processing tools used were CEREC Step Bur 12 S and Cylinder Pointed Bur 12 S. Machinability was evaluated by measuring time by milling first premolar crown case, and Biaxial flexure strength before the crystallization heat treatment. And for edge stability evaluation, veneer case of the central incisor was processed and chipping was observed with an optical microscope.

Results and Conclusions

Milling time of Premolar crown of Amber Mill and IEC was around 7 minutes, and Biaxial flexure strength was measured at 250 MPa and 234 MPa. Machinability of two products is shown to be similar without significant difference. When observing the margin after milling veneer case, it is confirmed that Amber Mill has less chipping than IEC, and has excellent edge stability.





02

Date (version No.) : 2021.03.12(Ver.01)
Product : Amber Mill
Type : In-house

Physical properties of Amber Mill

In this study, physical properties of Amber MIll were evaluated.

Materials and Method Information

The blocks were first cut into slices and milled to a suitable size of 12 mm in diameter and 1.2 mm in thickness use the milling machine. In order to obtain an optical finish, the specimens were polished to an average level of 0.012 μm. And heat treatment was performed according to the schedule recommended by the manufacturer (Biaxial flexure strength was evaluated in two groups before and after heat treatment.). Biaxial flexure strength was measured using a universal testing machine (GB 4201, Instron, Wycombe, UK) with 15 specimens according to ISO 6872. The Vickers hardness test was performed according to the C1327 standard using a Mitutoyo microhardness tester (Mitutoyo, Takatsu-ku, Japan) under a force of 2 kg for a constant indenter dwell time of 15 s. Fracture toughness was measured by an Vickers indentation fracture method. The length of the crack generated after the indenter indentation is measured, and the fracture toughness data is calculated using the elastic modulus data and the hardness data. Microstructure was observed using scanning electron microscope (SEM, JSM-6400, JEOL, Japan).

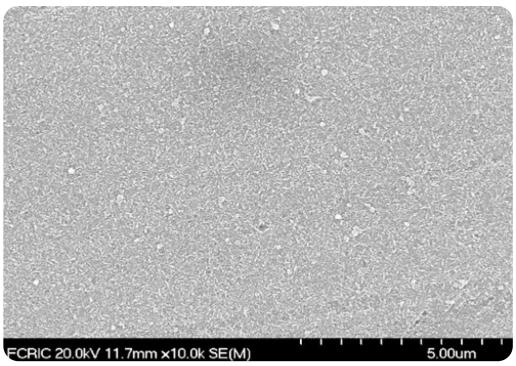
Results and Conclusions

※ Physical Properties

Blocks		Amber® Mill
Biaxial Flexure Strength (MPa)	Partially Crystallization	250 ± 46
	Fully Crystallization*	450 ± 42
Vickers Hardness (MPa)*		5700 ± 100
Fracture Toughness ($MPa{\cdot}m^{1/2}$)*		2.1 ± 0.3

※ 1) Source : Internal Data
2) * Estimated Values after fully crystallization

Amber Mill exhibits good Physical properties overall compared to other Lithium Disilicate blocks.



Date (version No.) : 2021.03.12(Ver.01)
Product : Amber Mill
Type : Paper Journal : Materials 2020, 13, 4680 DOI : 10.3390/ma13204680

Evaluation of the Milling Accuracy of Zirconia-Reinforced Lithium Silicate Crowns Fabricated Using the Dental Medical Device System: A Three-Dimensional Analysis

This study aimed to analyze the milling accuracy of lithium disilicate and zirconia-reinforced silicate crown fabricated using chairside computer-aided design/manufacturing (CAD/CAM) system. Mandibular left first premolar was selected for abutment.

Materials and Method Information

The experiment was conducted at a temperature of 23℃, in accordance with ISO 554. To maintain consistent experimental conditions, identical crown STL files were used for each material. For grinding burs, cylinder pointed bur 12S and step bur 12S were used. Fifteen crowns were fabricated, and then fabrication errors were removed, according to bur usage, by replacing the grinding bur. Crowns were set to cement space = 80 μm, occlusal milling o set = 125 μm, contact strength = 25 μm, and occlusal strength = 0 μm, while the most clinical library crown was applied, and the CAD Design STL file was completed. The completed STL file was transferred to a milling machine (inLab MC XL; Sirona Dental Systems GmbH, Bensheim, Germany) and 45 ceramic crowns, 15 crowns for each material, were fabricated. Three group were formed as follows: AM(Amber Mill), IEC, and CD group. The remaining parts were removed using a diamond bur grinder. Then, ceramic crowns underwent heat treatment, in accordance with the manufacturer's instructions, to complete the crystallization process.

Results and Conclusions

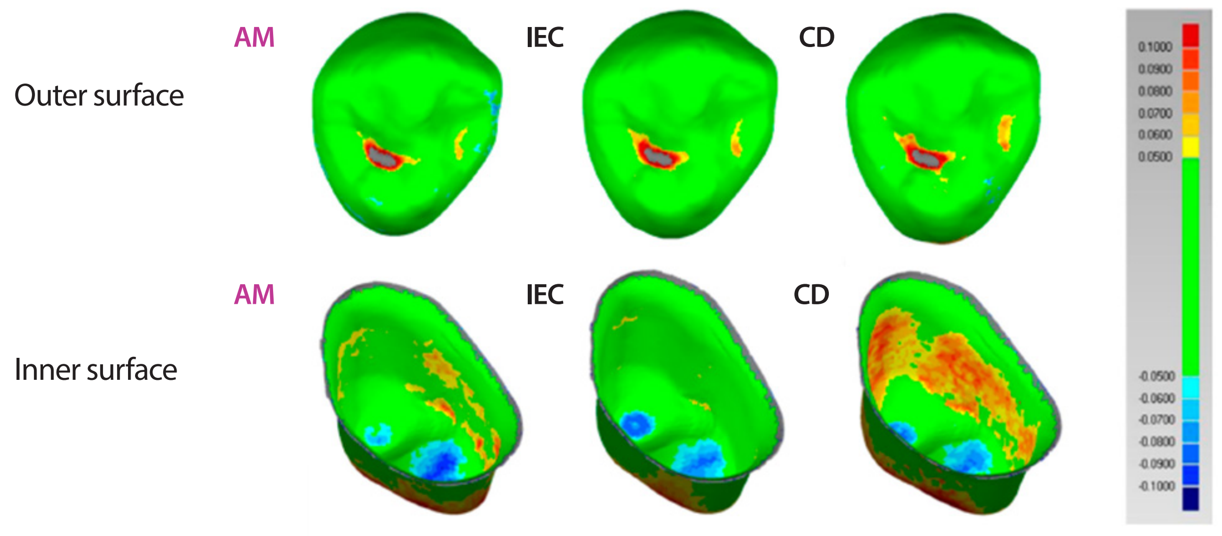
After processing of ceramic restorations using a CAD/CAM system, lithium disilicate was shown to have superior milling accuracy compared to zirconia-reinforced lithium silicate. According to the results from the qualitative analysis, a positive error appearing in the internal and external parts of the crown may not sufficiently match the fitting of the prosthesis, resulting in micro-discrepancies. In addition, a negative error may loosen the prosthesis due to excessive deletion. According to the results from the quantitative analysis, milling accuracy was within 120 μm for all types of ceramics, thus confirming their clinical applicability.

※Results of trueness Root Mean Square(RMS) for outer and inner surfaces of the ceramic crowns.

Trueness Results(RMS) for the Outer and Inner Surface of the Ceramic Crowns

Group	Outer Surface			Inner Surface		
	Mean ± SD	95% CI	p - Value	Mean ± SD	95% CI	p - Value
AM	38.30 ± 4.20 [a,b]	35.97-40.63	< 0.001	58.76 ± 6.55 [a,b]	55.13-62.38	< 0.016
IEC	34.89 ± 4.74 [a]	32.26-37.51		59.42 ± 8.89 [a]	54.49-64.34	
CD	40.38 ± 3.32 [b]	38.54-42.21		67.12 ± 3.76 [b]	65.03-69.20	

Unit: μm. AM: Amber Mill, CD, IEC, CI: confidence interval, SD: standard deviation.
a,b values followed by statistically significant differences based on the Mann–Whitney U test with Bonferroni correction ($p < 0.05$).

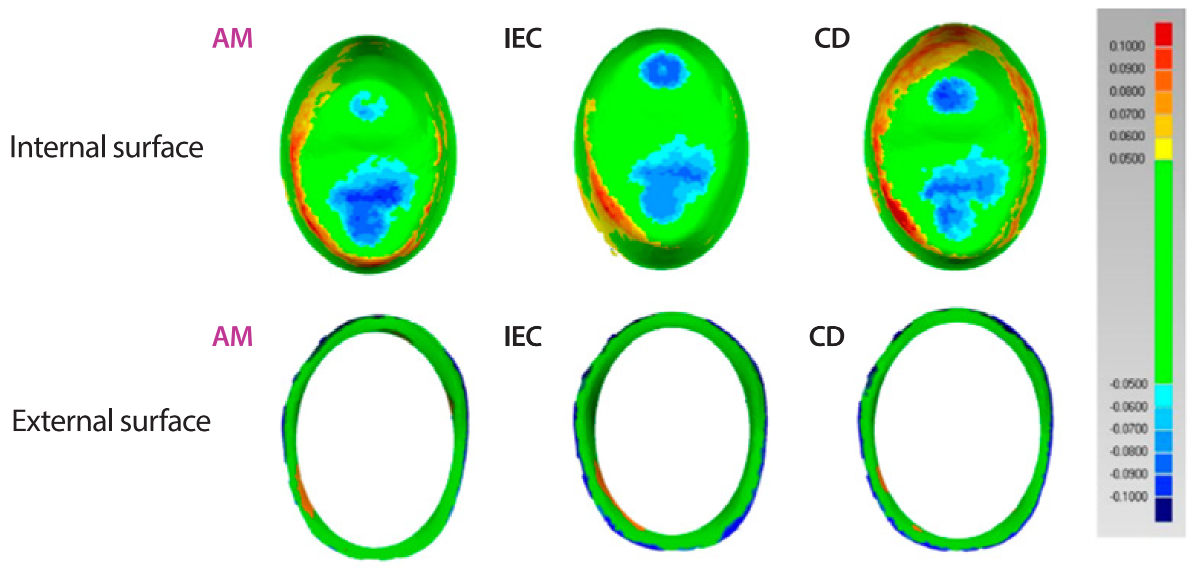


※Results of trueness Root Mean Square(RMS) for internal and externer parts of the ceramic crowns.

Trueness Results(RMS) for the Internal and External of the Ceramic Crowns

Group	Internal Part			External Part		
	Mean ± SD	95% CI	p - Value	Mean ± SD	95% CI	p - Value
AM	50.20 ± 7.37 [a]	46.12-54.28	< 0.001	85.73 ± 19.30 [a]	75.05-96.41	< 0.006
IEC	41.32 ± 4.42 [a]	38.87-43.76		108.11 ± 12.94 [b]	100.9-115.3	
CD	54.38 ± 3.72 [b]	52.32-56.45		103.34 ± 12.40 [ab]	96.48-110.2	

Unit: μm. AM: Amber Mill, CD, IEC, CI: confidence interval, SD: standard deviation.
a,b values followed by statistically significant differences based on the Mann–Whitney U test with Bonferroni correction ($p < 0.05$).



04

Date (version No.) : 2021.03.12(Ver.01)
Product : Amber Mill
Type : Paper Journal : KMID 2020, V.58 no.7
DOI : 10.22974/jkda.2020.58.7.005

Dental application of glass-ceramic materials for aesthetic restoration

Recently, along with the advance of fabrication methods of dental ceramics, the all-ceramic restorations with high esthetic and mechanical properties has increased and gradually replaced metal-ceramic restorations. Especially, CAD/CAM technology has opened a new era in fabricating the dental ceramic restorations. This overview will take a look at the past, present and future possibility of the dental ceramic materials.

Materials and Method Information

Two groups of blocks (IEC, Amber Mill) were prepared with the shade of LT A1. The blocks were first cut into slices and milled to a suitable size of 12 mm in diameter and 1.2 mm in thickness use the milling machine. 12 specimens were prepared for each group. Then, heat treatment was performed according to the schedule provided by the manufacturer. In order to obtain an optical finish, the specimens were polished to an average level of 0.012 µm.

Results and Conclusions

In order for the ceramic crown to resist the occlusal force of the posterior teeth, it must have a flexural strength of 350MPa or more. Lithium disilicate-based glass-ceramic is a material with good light transmission and aesthetics, so it can be applied to the anterior teeth without veneers, and its flexural strength is 400MPa or more, so it can resist the occlusal force of the posterior teeth, and can resist acid corrosion and silane due to HF.) Because it can be treated, strong bonding strength with resin can be obtained, and there is less abrasion of the clam compared to porcelain. Considering these points, it can be seen that the lithium disilicate-based glass-ceramic material has properties suitable for single tooth restoration of the pre-tooth part. However, in order to further increase its clinical application, it is believed that more research and understanding of these materials will be needed.

※Weibull analysis of biaxial flexure strength of IEC and Amber Mill.

Group / Para	IEC LT A1	AmberMill LT A1
Size & Shade	C14/LT A1	C14/A1
Lot No.	V23467	EBE05LA1701
m	7.697	13.244
σ_0	443.1	515.6
$\sigma_{f(avg)}$ ±SD	417.7 ± 58.2	497.0 ± 39.7
N	12	12

σ_0 = characteristic strength in MPa; m = weibull modulus;
$\sigma_{f(avg)}$ = mean fracture strength in MPa; N=number of samples.

05

Date (version No.) : 2021.03.12(Ver.01)
Product : Amber Mill
Type : In-house

Aesthetics of Amber Mill

In this study, aesthetics of the Lithium disilicate block was confirmed. Opalescence and fluorescence according to light were observed, and Amber Mill and IEC group were compared with natural tooth.

Materials and Method Information

Specimens for each group were heat treated according to the schedule recommended by manufacturer. First, using a fluorescent lamp as a light source, opalescence of specimen according to transmitted light and reflected light were observed.
Then, as a UV light source, fluorescence according to reflected light was observed.

Results and Conclusions

Amber Mill, like natural teeth, was bluish when viewed under reflected light and orange when viewed under transmitted light.
Amber Mill showed fluorescence similar to that of natural teeth compared to IEC, indicating that it has superior fluorescence.

Figure 1. Opalescence

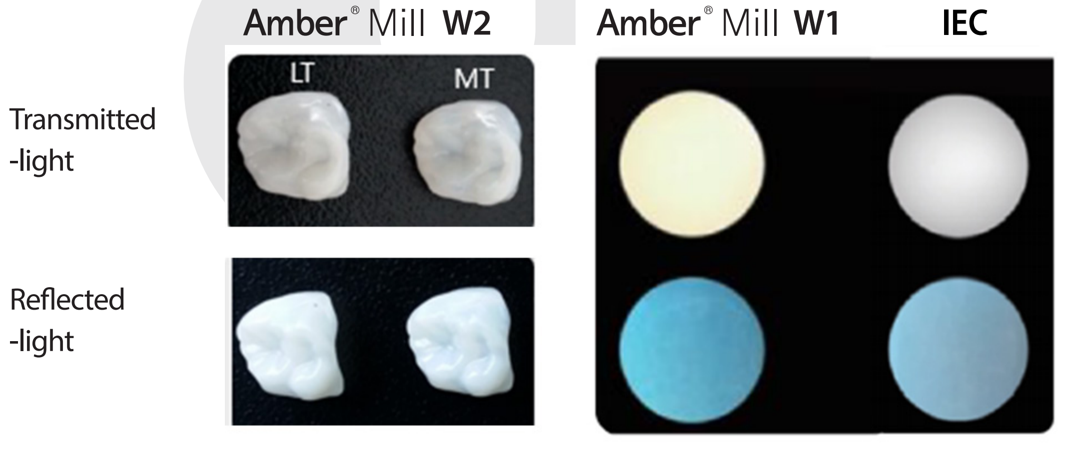
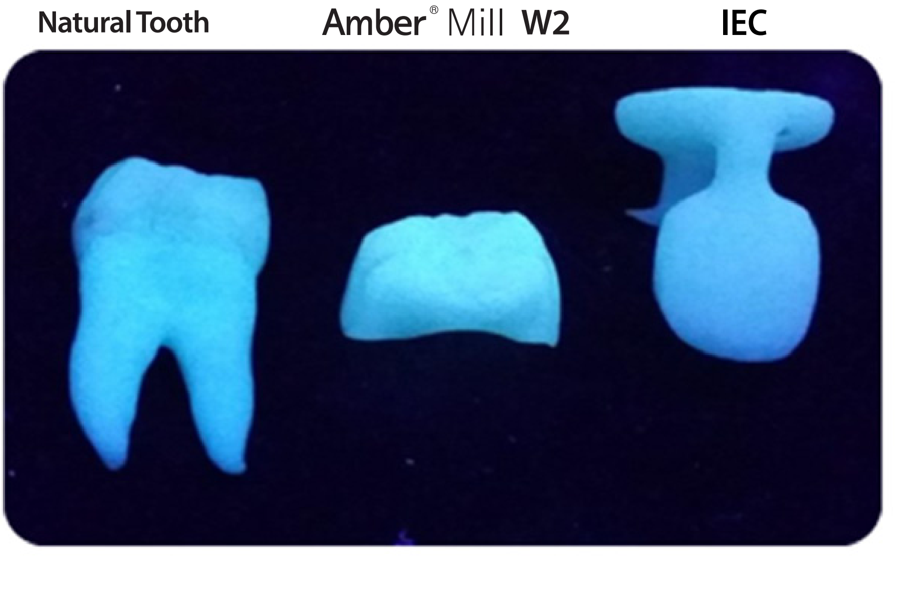


Figure 2. Fluoresecence



Date (version No.) : 2021.03.12(Ver.01)
Product : Amber Mill
Type : Paper Journal : Materials 2019, 12, 2252 DOI : 10.3390/ma12142252

Comparative Evaluation of Mechanical Properties and Wear Ability of Five CAD/CAM Dental Block

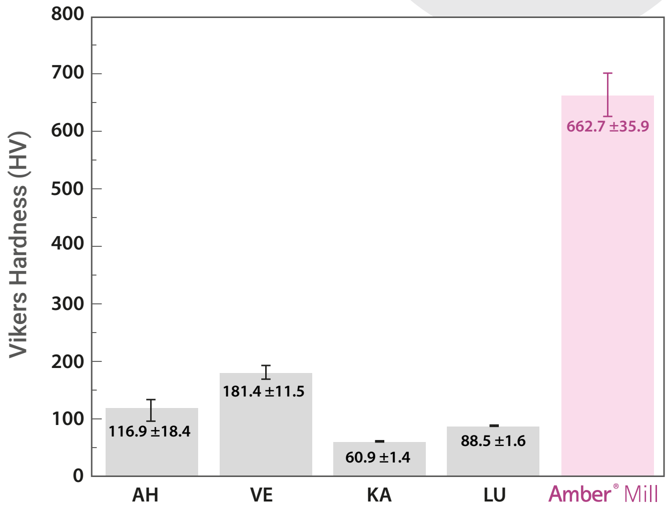
This study compares the mechanical properties and wear ability of five CAD/CAM (computer-aided design/computer-aided manufacturing) millable dental blocks. All the discs, including AH, VE, KA, LU, and Amber Mill(AM), were cut in dimensions of 1.2mmin thickness and 12mmin diameter, polished to a machined surface, and immersed in distilled water for seven days.

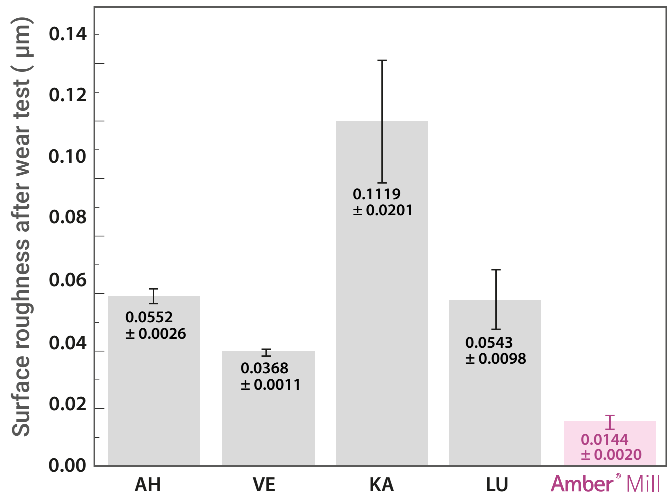
Materials and Method Information

The blocks of each material were received from the manufacturers, and five groups of samples were prepared in the experiment (20 samples per material). The blocks were first cut into slices and milled to a suitable size of 12 mm in diameter and 1.2 mm in thickness use the milling machine. In order to obtain an optical finish, the specimens were polished to an average level of 0.012 μm. In order to simulate the hydrolytic degradation of the sample interface components, all samples were cleaned using ultrasonic waves for 1 min and then stored in distilled water at 37°C for 7 days.

Results and Conclusions

From our comparison of five different groups of dental restoration materials, we found that all the tested materials exhibited varying degrees of mass loss and surface roughness. In addition to AM as a glass ceramic exhibits a higher biaxial flexure strength, the other four resin composites are distributed from 138.9 MPa to 281 MPa, therefore these CAD/CAM composite materials are more suitable for single crowns in the anterior region and not recommended for fixed-bridge restorations.





※Table . Weibull analysis of biaxial flexural strength.

	AH	VE	KA	LU	Amber® Mill
m	6.40	20.94	8.58	11.33	8.63
σ_{max}	163	138.9	281	183.7	631.1
σ_f ±SD	134.34 ± 6.40	126.34 ± 6.63	240.88 ± 29.62	161.93 ± 11.33	529.46 ± 63.67
BP	2.14 ± 0.35	2.93 ± 0.26	5.64 ± 1.23	3.29 ± 0.59	6.36 ± 1.17
N	14	14	14	14	14
R^2	0.96	0.92	0.96	0.98	0.94

m : Weibull modulus, σmax : maximum biaxial flexural strength (MPa), σf: average biaxial flexural strength (MPa), BP : number of broken piece, N : number of samples, R^2 : Weibull distribution regression.

Date (version No.) : 2021.03.12(Ver.01)
Product : Amber Mill

Type : Paper
Journal : J Adhes Dent. 2021 Oct 1;23(5);469-475
DOI : 10.3290/j.jad.b2000265

Composite cement components stabilize the bond between a Lithium-Disilicate Glass-Ceramic and the Titanium Abutment

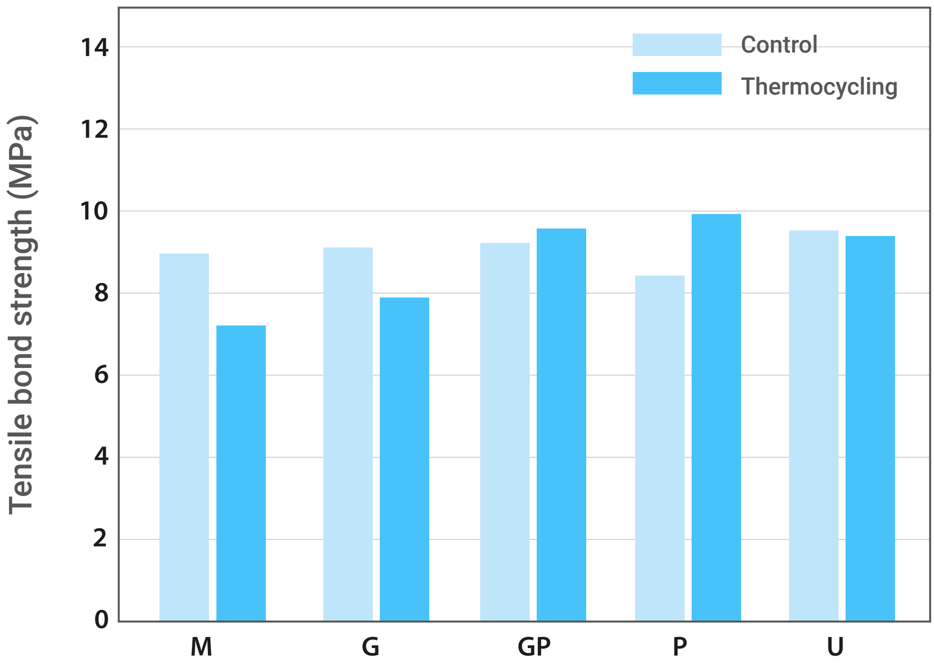
Lithium disilicate has higher esthetic properties due to superior translucency than zirconia, but relatively low strength has been reported. Compared with the initial period, lithium disilicate is reported to increase in strength due to the improvement of the material, and implant restorations are also increasing. Lithium disilicate restorations are capable of stable adhesion to teeth through surface treatment, but consideration of adhesion strength is required when adhesion to implant abutments. In this study, the tensile bond strength between the implant titanium abutment and the lithium disilicate restoration was compared according to the thermal cycling treatment and the type of cement.

Materials and Method Information

Amber Mill, a product processed by aligning the inner surface of the lithium disilicate block to the Ti abutment (TiBase, Dentsply Sirona), was used. Eighty LS2 blocks were treated with five types of composite cement and primer, then divided accordingly into groups: M (Multilink hybrid abutment), G (G-CEM LinkAce), GP (G-CEM LinkAce with G-Multi PRIMER), P (Panavia F2.0), and U (RelyX U200). Half of the 16 specimens from each group were subjected to thermocycling (groups T-M, T-G, T-GP, T-P, and T-U). The inner surface of the LS2 block was etched with 4% hydrofluoric acid(4% Porcelain Etchant, Bisco) for 30 seconds, washed, and then treatmented with a silane coupling agent(Monobond N, Ivoclar Vivadent) for 1 minute. Composite cement was used to bond the titanium Ti abutment to the abutment The thermal cycling experimental group was subjected to 6000 thermal cycling treatments (5/55°C). The prepared specimen was measured for tensile bond strength with a universal testing machine using a pull-out jig designed for this study.

Results and Conclusions

Tensile bond strength of Amber Mill block and the Ti abutment was different according to the composite cement type. Thermocycling can reduce the bond strength between the composite cements and Ti abutment. The composite cements containing 10-methacryloyloxydecyl dihydrogen phosphate (10-MDP) or methacrylate phosphate ester monomers stabilize bonding.



Group / Result	M*		G**		GP**		P**		U**	
	Control	Thermocycling	Control	Thermocycling	Control	Thermocycling	Control	Thermocycling	Control	Thermocycling
Mean ± SD (MPa)	8.92 ± 0.66	7.16 ± 0.52	9.03 ± 0.23	7.79 ± 0.82	9.13 ± 0.59	9.57 ± 0.21	9.37 ± 0.49	9.91 ± 1.07	9.46 ± 0.30	9.33 ± 1.08
Difference	Decrease		Decrease		Maintain		Maintain		Maintain	

Date (version No.) : 2021.03.12(Ver.01)
Product : Amber Mill
Type : Paper DOI : 10.1016/j.jmbbm.2021.104456
Journal : Journal of the Mechanical Behavior of Biomedical Materials, Vol. 118 (2021), 104456

Modern CAD/CAM silicate ceramics, their translucency level and impact of hydrothermal aging on translucency, Martens hardness, biaxial flexural strength and their reliability

To investigate the impact of hydrothermal aging on Martens parameter (Martens hardness: HM/elastic indentation modulus: EIT) and biaxial flexural strength (BFS) of recently available CAD/CAM silicate ceramics. Six CAD/CAM ceramics in two translucency levels (LT/HT): (a) two lithium disilicate (Amber Mill, IEC), (b) one lithium metasilicate (CD), (c) one lithium alumina silicate (NIC), and (d) two leucite ceramics (ILB, IEM). HM/EIT and BFS were measured initially and after hydrothermal aging in an autoclave.

Materials and Method Information

Ceramic cylinders (length: 14 mm; diameter: 12 mm) were milled using a computer-aided milling unit (Ceramill Motion 2, Amann Girrbach AG, Koblach, Austria) and the respective software (ceramill motion - EST 1274–47.10). Rectangular discs were cutted out of the cylinders with a cutting machine (thickness: 1.8 mm) under constant water cooling at a speed of 0.05 mm/s of a diamond cut-off wheel. Lithium disilicate and lithium metasilicate ceramics were crystallized in a ceramic furnace (Programat S1 1600, Ivoclar Vivadent, Schaan, Liechtenstein) according to the manufacturer's instructions. All specimens were mechanically polished to high gloss from both sides under water to a thickness of 0.95 mm (±0.03 mm). In total, 220 specimens were fabricated from six CAD/CAM silicate ceramics (n = 40 per ceramic and n = 20 per translucency level LT or HT, except for IPR) with only LT). Half of the specimens (n = 110) were initially assessed regarding HM/EIT and then BFS on the same specimen. The other half (n = 110) was subjected to hydrothermal aging in an autoclave (Euroklav 29-S, Melag, Berlin, Germany) at 134℃ at 0.2 MPa (2 bar) for 100 h and analyzed for HM/EIT and BFS consecutively on the same specimen, respectively. Martens parameter were measured using a universal testing machine (Zwick/Roell ZHU 0.2/Z2.5, Zwick, Ulm, Germany). Half of the specimens (n = 110) were measured initially, measurement of the other half was carried out after hydrothermal aging according to the specifications of the test standard DIN EN ISO 14577 with the respective software (testXpert, Zwick Roell, Ulm, Germany).

Results and Conclusions

Within the limitations of the present in-vitro investigation, following conclusions could be drawn:
Differences between the CAD/CAM ceramics were observed. Lithium silicate ceramics presented higher mechanical properties than leucite ceramics. In respect to lithium silicate ceramics, not all of these ceramics show the same properties. Lithium alumina silicate ceramics showed lower values than lithium disilicate and lithium meta silicate ceramics. Lithium disilicate ceramics presented the highest flexural strength. The reliability was better for leucite than for lithium silicate ceramics.

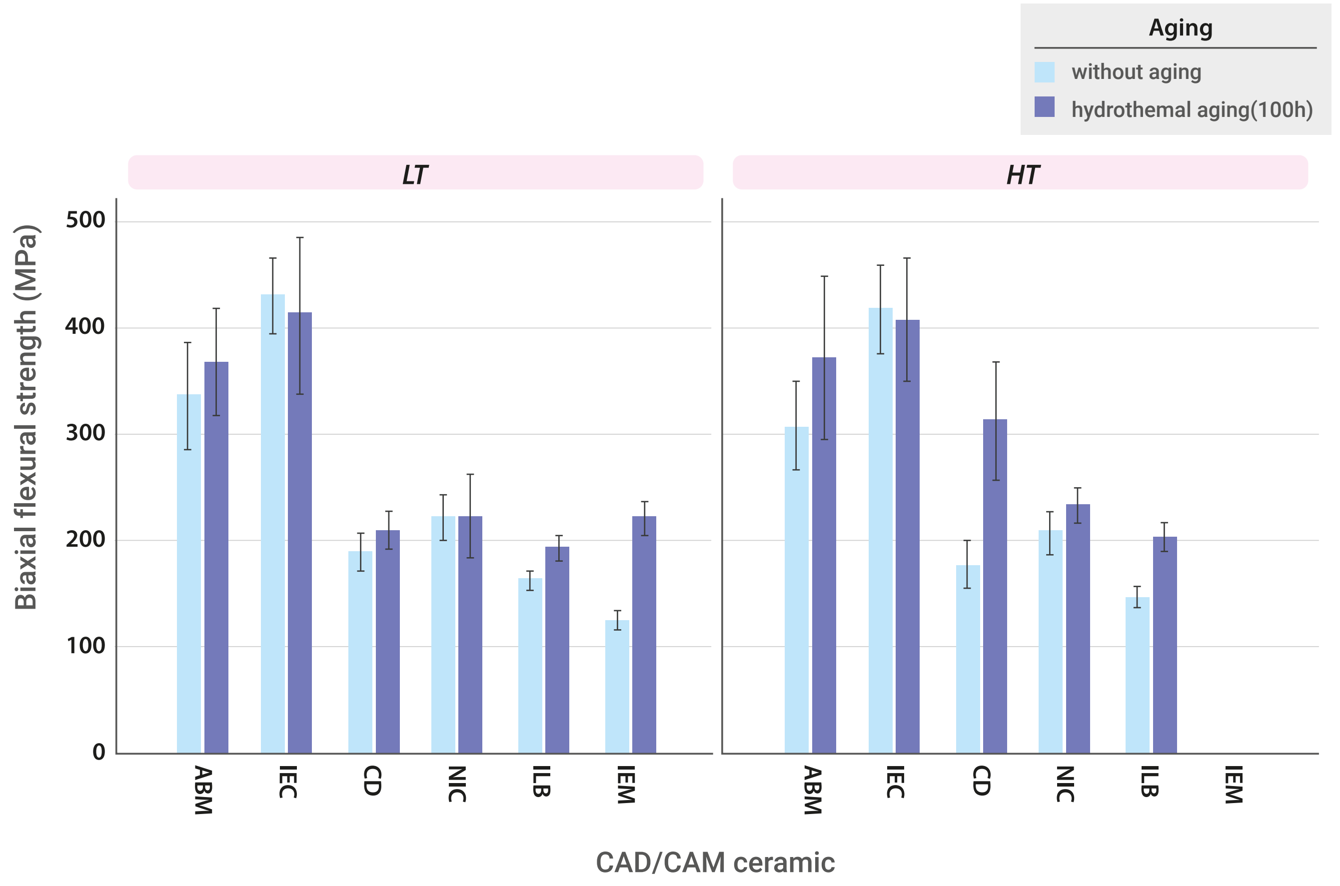


Fig. 2. Biaxial flexural strength for both translucency levels prior and after hydrothermal aging for each CAD/CAM ceramics, separately.

Table 5
weibull statistics of biaxial flexural strength in [MPa] with Weibull modulus(m) and characteristic strength (s) with 95% confidence interval (CI) of CAD/CAM silicate ceramics.
CAD/CAM ceramics were arranged according to Table 1 and within these groups alphabetically.

Silicate ceramic type		Ceramic	Translucency level	Initial		Hydrothermal aging	
				Weibull module (95% CI)	Characteristic strength (95% CI)	Weibull module (95% CI)	Characteristic strength (95% CI)
Reinforced	Lithium disilicate	ABM	*LT*	5.11 [2.65; 9.80]	365 [318; 416]	5.60 [2.92; 10.7]	396 [350; 447]
			HT	5.71 [2.97; 11.0]	332 [294; 374]	3.70 [1.92; 7.07]	412 [342; 494]
		IEC	*LT*	10.1 [5.28; 19.5]	452 [423; 283]	4.42 [2.29; 8.48]	451 [386; 525]
			HT	7.79 [4.05; 15.0]	442 [404; 483]	5.16 [2.68; 9.89]	442 [386; 503]
	Lithium metasilicate	CD	*LT*	8.77 [4.58; 16.8]	200 [184; 217]	9.29 [4.83; 17.8]	219 [203; 236]
			HT	6.54 [3.41; 12.5]	189 [169; 210]	5.37 [2.80; 10.3]	337 [296; 382]
	Lithium alumina silicate	NIC	*LT*	9.11 [4.74; 17.5]	234 [216; 252]	4.56 [2.36; 8.73]	243 [208; 282]
			HT	7.55 [3.93; 14.5]	220 [201; 241]	12.3 [6.39; 23.5]	242 [227; 256]
Non-reinforced	Leucite	ILB	*LT*	17.7 [9.21; 33.9]	167 [159; 174]	12.4 [6.50; 23.8]	199 [187; 211]
			HT	13.0 [6.75; 24.9]	152 [143; 161]	14.7 [7.66; 28.1]	209 [199; 220]
		IEM	*LT*	13.1 [6.80; 25.1]	130 [122; 137]	11.6 [5.83; 23.0]	230 [215; 245]

Amber® Mill

Human-Aid
System Supplier
HASS

AM_TR_ver.01_EN_220511